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A comparative study on risk management practices between international and local contractors in the Ethiopian roads construction industry

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A Thesis Submitted to College of Architectural and civil Engineering in partial Fulfillment of the Requirement of Master of Science in Civil Engineering (Construction Technology and Management).

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APPROVAL PAGE

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DECLARATION

This is to certify that this thesis entitled "comparative Risk Management Techniques Between local and international contractors in Ethiopian road construction industry submitted in partial fulfillment of the requirements for the award of the degree of MSc in construction technology and management in Addis Ababa Science and Technology University, done by Eshetu Adugna under my guidance. To the best of my knowledge and belief the work contained in this thesis has not been previously submitted for a degree or diploma at any other higher education institutions.

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Abstract

The objective of the study is to compare the road construction risk management practices of Local and International road contractors in Ethiopia and recommend possible ways of improving the practice of road construction risk management. Questionnaire, Checklist and interview were used as qualitative and quantitative data collection tools in this research. The main method applied for classification of data is tables. The analysis of data involved computation of statistical tools such as frequency, percentage analysis, Chai square and binomial test techniques and (SPSS) version 20 to indicate the level of agreement or significance of each question applied to analyze. From the summarized analysis result,25 essential elements of the road construction risk management practices local and international road contractors similar on only 6 elements which is 24% and varies with 18 elements which is 76%. The study investigated that there is limited understanding of road construction risk management practices among the local stakeholders. In addition, there is no formal method of risk mitigation strategies used by the stakeholders. Considering the assessment made through the checklist, the results showed that there is limited knowledge and understanding of road construction risk identification related concepts. Generally, it was also found that the lack of joint risk management practices by stakeholders and shortage of knowledge on road construction risk management practices were the most common barriers, and in the life cycle of road projects, critical risks at the planning and design stages are mostly allocated to the client or consultant while at the construction stage a high percentage of critical risk is allocated to contractors. The study concludes that risk management should be a shared responsibility among stakeholders to the contract and education on road construction risk management is needed to ensure quality construction activities at all phases of the project life cycle.

Key words, Road construction industry, Local and International contractors

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List of abbreviations

AACRA	Addis Ababa city road authority
BOT	build-operate-transfer
CRMS	Construction risk managements
DB	Design built
DBB	Design- Bid- Build
DBFO	Design-build-finance-operate
EACE	Ethiopian Association of civil Engineering
ECAE	Ethiopian Conformity Assessment Enterprise
EIA	Ethiopian engineers Association
ERP	Emergency Recovery Program
ENR	Engineering News-Record
ERA	Ethiopian Roads Authority
FIDIC	Federation International Des Ingenious Cosell's
JRAP	Judgmental risk analysis process
JV	Joint Venture
MoFED	Ministry of Finance and Economic Development
MoWUD	Ministry of work and urban Development
OSPMI	Office of state wide project management improvement
PBCs	Performance based contracts
PMBOK	Project management book
PMI	Project Management Institute
PPP	Public/private partnerships
RFA	Road Fund Administration
RM	Risk management
RMP	Risk management process
RSDPs	Road Sector Development Programs
SHAMPU	Shape, Harness, and Manage Project Uncertainty
SMEC	Siemens Manufacturing and Engineering Center

CHAPTER 1

INTRODUCTION

1.1 Background of the study

Road is an important infrastructure constructed by government or private sector to give transport services for passengers and goods movement safely from one place to other for demanded requirement. It is key to create links between regions, cities and localities in order to facilitate development of the nation following, the railway infrastructure. Road construction involved more risk than other construction sectors due to the complexity of the coordinating various activities, in Ethiopia. In addition to this, each project is unique and encompasses new technology, techniques and procedures. For instance, road construction is more of an equipment intensive than labor based. The sequences of activities entailed to be strictly followed and the projects involve high cash flow than other construction sectors. Due to these factors, considerable risk management should be applicable on road construction industry.

The core element of project success is to meet the time, cost, and quality as targeted. In order to achieve these targets, effective risk management should be present and given due attention. If not, risk may appear in many ways and could result in time and budget overrun, financial losses, loss of life, environmental damage, and many more failures. Therefore, a project can be positively made success by considering the risks where it normally tends to give positive and negative effects on the project (Ayyub and Wilcox, 2000).

Attempts made to develop various efforts on the road construction sector of Ethiopian Roads Authority (ERA) to ensure projects' success. Road Sector Development Programs (RSDPs) which provide a coordinated framework for intervention along with policy, institutional and regulatory reforms have been launched. These programs aimed at developing an efficient and self-sustaining construction industry and improving the management of the road sector (Anon, RSDP report, 2015).

Following the establishment of RSDP, Road Fund Administration (RFA) was established later on as separate financing body. In this regard, RFA establishment brought up the private sector in to active participation, by way of strengthening Contractors' competitive capacity to undertake construction and maintenance works.

Similarly, the midterm and final reviews of the RSDPs shows that despite the achieved improvement perceived in performance and productivity within the sector, there are lingering problems of delay and cost overrun of all road construction projects. It is also identified that there is necessity for further strengthening of institutional capacity, adoption of new construction technologies, modern project management principles and additional regulatory reforms. This helps to maximize the efficiency of the Ethiopian road construction industry (RSDPII , 2005). Consequently, it is found very essential to investigating the effective Risk management system in critical areas of road construction projects that required focused attention to adopt an appropriate intervention mechanism by Government and local practitioners.

1.2. Statement of the problem

The road construction industry as a whole suffers from institutional, organizational and technical problems. Road management practices in the industry are still accomplished in the traditional method. According to (Wubshet J. 2002), the problems of road construction projects in Ethiopia are categorized under the following three major characteristics. These are,

- Scarcity of resources,
- Unique human and organizational problems,
- Uncritical adaptation of technologies and
- Management.

As the result, the current participation of local contractors could not satisfy the Federal set requirements regarding roads construction for the nation.

According to ERA mid -term review,2005 the participation of local contractors and consultants in donors financed projects is limited due to lack of experience and finance. This

is the challenge to allow local contractors to meet the eligibility criteria for pre-qualification. Specially to fulfil the expected criteria on the past performance, equipment availability and as well stable financial status (Anon, RSDP II, 2005).

In addition to that road sector development program in Ethiopia also shows that the performance of contractors is unsatisfactory on projects that are not committed to the contractual time, budget and scope and as well fails to meet client satisfaction. This in turn hinders the development of road construction in Ethiopia that limits the involvement of local contractors in construction while the foreign contractors win projects with much expensive contract cost. Similarly, as indicated in Addis Ababa City Road Authority (AACRA) two years' annual report most of local contractors are moving out of the road construction sector as they face problems related to low performance (AACRA Annual report, 2014).

To alleviate this challenge, AACRA introduced risk guarantee system. This risk guarantee shall be submitted by all local contractors named as "Contractors all Risks". This give contractors the chance to prolong their contracts rather than termination and encourage local contractors to stay in the sector (AACRA reoprt, 2005). However, some of the contractors engaged the program never shown progress and evidenced behind contractual commitment. Therefore, this research will investigate the failure of this risk management system, in this case scenario.

Moreover, in ERA for RSDP the government awarded 14 rural road projects in 1995 with 20% advance payment to different local contractors in order to build their capacity. These contractors have been given the advance without submitting collaterals in terms of the aim for enhancing their capacity. Even government supported them (as stated in the above), most of the contractors' performance was found low and some contractors have dropped out of the sector. For instance, Baro Construction (Gog-Akobo road), Ajeco Construction (Wenbera-Guba) and African Engineers (Alme Ketema-Sekotwere) are among a few contractors who disappeared and still striving for existence.

According to the Ministry of Works & Urban Development Report (MoWD,2005)manylocal contractors that have been registered in different categories (GC1,BC1, and RC1-GC6, BC6

andRC6) revealed thatthe contractors dropped out of the construction sector at an alarming rate. For instance, an average of ten years' report shows 40.21% of the contractor dropped out of the sector (ReferAnnexTable 1.) In the reflection, this research will investigate if contractors poor risk management performance is contributing factor for this failure.

1.3. Objective of the study

1.3.1 General Objective

The general objective of the study is to compare the road construction risk management practices of local and international road contractors in Ethiopia and recommend possible ways of improving the practice of road construction risk management.

1.3.2. Specific objectives

- To critically review the existing knowledge and experience from journals, research papers, reference books, and website to enhance the research input activity;
- To assess the practice of risk management of local contractors in Ethiopian road construction industry;
- To identify critical risks experienced by local contractors in the Ethiopian road construction industry.
- Identify risk management strategies used to mitigate critical risks by local contractors in Ethiopian road construction industry.
- To compare risk management system of local contractors against that of international contractors; and
- Finally, to recommend possibly improved system that can be adopted by local contractors and to enhance the current practice

1.4. Research Questions

Any research under investigation would constitute question to be answered during the process of study. In this regard, the following research questions are formulated as follows.

- How is risk management perceived by local and international contractors in Ethiopian road construction industry?

- How is road construction risk management practiced by local and international contractors in Ethiopian road industry?
- What management techniques are used to mitigate critical risks by local contractors in Ethiopian road construction industry?
- How are the risk management practices of local contractors compared to international contractors?

1.5. Scope and limitations of the study

This research is limited to studying the risk management practice of local contractors in road construction projects as compared to international projects. Due to the vast problems observed in road construction industry, this research mainly limited its scope in road projects. Within limited time and money, this research is not expected to cover in depth case studies of large projects which would have been helpful for this study. However, with the devised methodology the research is expected to reveal the shortcomings of the local road contractors practice and gives clear view of the future measures to be taken to alleviate the challenges.

1.6. Significance of the study

The study indicates areas of improvement which require attention from all practitioners involved in road construction risk management. It also shows that what should be done to develop the sector; in regarding road construction risk management practices of Ethiopian road projects. Also, attempts to suggest what can be done to improve the capacity of managing risk in road construction. It is believed that areas assessed in this study could trigger an intellectual debate among actors involved in the risk management of road construction projects. The suggestions of the study are major benefit for designing of effective road risk management practices and practical intervention mechanism which will enhance the performance of the Localroad construction industry.

1.7. Outline of the thesis

This thesis consists of five chapters and Appendix. Therefore, the details of each chapter presented hereunder for quick reference.

Chapter One – Presents an introduction to the research and includes seven sections that present background of the study, the problem of statement, the objective of the study and research questions, Scope, limitation and significance of the study.

Chapter Two - Reviews related literatures with different sub titles linked with road construction Risk management.

Chapter Three -Presents the materials and methods that includes five sections, research design and approach, source and type of data, sampling design and population of the study, data collection methods, data analysis and interpretation techniques.

Chapter Four - presents the results with their discussion.

Chapter Five -Presents the conclusions and recommendations of the study and

Appendix: -contains different tables and binomial tests by EBSS version 20

CHAPTER TWO

2.0. LITERATUREREVIEW

2.1 Definition

The Random House College Dictionary defines risk as "exposure to the chance of injury or loss" (Hertz and Thomas 1983). Defined Risk as the exposure to loss/gain, or the probability of occurrence of loss/gain multiplied by its respective magnitude. He further explains that events are said to be certain if the probability of their occurrence is 100% or very uncertain if, the probability of occurrence is 0%. In between these extremes, the uncertainty varies quite widely.

Many explanations and definitions of risks and risk management have been recently developed, and thus it is difficult to choose one, which is always true. Each author provides his own perception of what risk means and how to manage it. The description depends on the profession, project, and type of business (Samson.s.Reneke, 2009)

Risk management (RM) is a concept, which is used in all industries, related to the construction sector. Each industry has developed their own RM standards, but the general ideas of the concept usually remain the same regardless of the sector. According to the Project Management Institute (PMBOK Third edition, 2004), project risk management is one of the nine most critical parts of project commissioning. This indicates a strong relationship between managing risks and a project success, while RM is described as the most difficult area within construction management and its application is promoted in all projects in order to avoid negative consequences (Winch, 2002)(Potts, 2008).

In terms of strategic decision-making, the risks can be categorized into three groups:

- Probabilistic risks,
- Unpredictable risks and
- Uncertain risks

The first type of risk is predictable and organizations know they face it. This is probably the most straightforward type of risk to manage using a formal statistical approach. In the

context of probabilistic risk, both likelihoods and outcomes of unwanted events are well understood and defined (Mac Crimson, K.R. &Wehrung, D.A. 1986). It is in essence more difficult to manage the second type of risk. An organization knows that it may encounter these risks. However, the causes of these risks are essentially distinctive in nature, and cannot be predicted by formal statistical approach (Mac Crimson, K.R. &Wehrung, D.A. 1986).

In the context of organizational characteristics, four organizational sources influence the risk behavior. They are summarized as follows

- Group decision-making practice (group decision-making context);
- Organizational risk culture values;
- Leadership (leader's influence) and
- Organizational control system.

There are strong indications that individuals "do not trust, do not understand or simply do not use precise probability estimates", and they therefore come up with incorrect estimations about the potential consequences that lead them into ineffective decisions. Risk management in general is a very broad subject and definitions of risk can therefore differ and be difficult to apply in all industries in general. For the purpose of this thesis, one definition of risk and risk management will be chosen, in order to have a clear understanding of these concepts in construction industry.

Risk Management is a logical, systematic and process oriented approach that: minimizes losses and maximizes opportunities through enabling improvements in decision making; and establish the context for risks involved in any activity or process that need to be identified, analyzed, treated and monitored(Wubshet J. Mengesha.,2006).

2.1.1 Basic Risks on Road construction projects

Road construction project risks are interrelated but interdependent. The customary origins for project risks are the following (U.S. Department of Transportation, 2006): Performance, scope, quality, or technology issues; Environment, safety, and health concerns; Scope, cost, and schedule uncertainty; Political concerns. Risk will be peculiar to each particular project and each project participant, however, it is recognized that all construction projects share common risks that can be classified as follows:

- Changes in the work, Subsurface geological and geotechnical conditions,
- Site access, Level of detail design delivered by the owner,
- Late drawings and instructions, Availability of resources, Accidents (such as collision, fire)Damage to persons or property,
- Defective design, Cost of tests and samples, Actual quantities of work,
- Equipment commissioning, Financial and economic, Inflation and Funding,
- Performance productivity of labor, Productivity of equipment,
- Suitability of materials, Defective work, conduct hindering performance of the work, Labor disputes.

The U.S Department of Transportation (2006) adopts the following risk organization structure: Technical risks,design process, owner involvement in design, Inadequate and incomplete design, change in seismic criteria, Errors in completion of structural / geotechnical / foundation, wrong selection of materials, take off data (traffic demand, water consumption demand, etc.), Need for design exceptions

Construction risks, Inaccurate contract time estimates, Construction procedures, Construction occupational safety, Work permissions, Utilities, Late surveys, incomplete or wrong, Delayed deliveries and disruptions, Worker and site safety, Innovative projects, Unsuitable equipment and materials, Environmental risks (such as projects close to a river, floodplain, coastal zone, high habitat sensitivity, and so on)

Environmental factors, environmental analysis incomplete or wrong, offsite and onsite wetlands, Hazardous waste, preliminary site investigation wrong, lack of specialized staff (biology, anthropology archaeology, etc.)

External risks, contractual relations, landowners unwilling to sell, priorities change on existing program, Funding changes for fiscal year, stakeholders request late changes, new stakeholders, additional needs requested by stakeholders, new information required for permits, Inconsistent costs, time, scope, and quality objectives, Permits and licenses.

Force majeure factors, political factors change (political interference), economic instability, market conditions, exchange rate fluctuation, public safety regulation

Social factors, local communities pose objections, environmental factors, environmental regulations change, water quality issues, New information required for permits, environmental impact statement required, historic site, endangered species, or wetlands present, pressure to compress the environmental schedule.

Organizational risks, inexperienced staff assigned, losing critical staff at crucial points of the project, insufficient time to plan, unanticipated project manager workload, not enough time to plan, priorities change on existing program, inconsistent cost, time, scope, and quality objectives

Project management risks, project purpose definition, needs, objectives, costs, deliverables are poorly defined or understood, no control over staff priorities, too many projects, consultant or contractor delays, estimating and/or scheduling errors, communication breakdown with project team, lack of coordination / communication, inexperienced workforce / inadequate staff / resource availability.

It is important to capture all potential risks in a project and undertake all necessary actions or make provisions for eliminating or preventing them from occurring. Alternatively, the effects of risks may be reduced and allocated to the party best prepared for managing them. This requires a systematic approach to risk management.

The researcher agrees with the above risk factors, but would like find out the applicable once Ethiopian context.

2.2. Road Construction Projects Risk Management

Road construction risk management is a concept which should be managed in early stage of a project. Companies often establish a construction risk management procedure in their projects for improving the performance and increase the profits of Projects undertaken. In road construction sector are widely complex and have often significant budgets, and thus

reducing risks associated with must be given priority, for each project actors that go with success parameters of project in time completion, within specific budget, requested performance and technical requirement. Road construction projects can be unpredictable and managing risks in construction projects recognized very important process in order to achieve project objectives in terms of time, cost, quality, safety, and environmental sustainability (Zou PXW, Zhang G, Wang J, 2007).

According to (Flanagan and Norman 1993), the road construction industry is subject to more risk and uncertainty than many other industries. The development of a construction project from inception to completion takes long time and involves many phases. Road construction projects are sensitive to an extremely large matrix of hazards and risks, due to some of the inherent characteristics of construction projects, which can be summarized by (Bunni, 2003) as follows,

- Time required to complete road construction project is comparatively high.
- Human resource requirement is diverse and changes over time and from phase to phase.
- Projects location/ geographically dispersed and sometimes situated in isolated regions of difficult terrain.
- Large diverse pool of materials required with advanced and complex technology and extensive interaction among the parties involved in construction lead to team work and inherent conflicts.

All parties involved in road construction project must accept that there is some risk attached to their activities. If one cannot control a risk through a business practices or transfer that risk to someone else through an indemnification clause, then the risk can be managed that risk through insurance (Ratterman, 2003). Some risks have enormous size in financial terms and the party to whom a risk is allocated may want to cover it by means of insurance (Akbiyikli, 2012).

Construction project parties, whether they are the owner, contractor, engineer or supplier, can protect their interests by insurance but must accept that not all risks are insurable (ERASMEC, 2008). Insurance is not the only means by which risks associated with

construction and infrastructure projects may be addressed, however, it is one of the principal means by which parties to major projects treat risk.

2.3. Limits of risk management

The level of risk is always related to the project complexity (Darnall and Preston, 2010). The fact that there are so many risks, which can be identified in the road construction industry, can be explained by the projects size and their complexity. "The bigger the project is, the larger the number of potential risks that may be faced. Several factors can stimulate risk occurrence.''

Other influences on the occurrence of risk are the level of technology used and the organization's risks (Gould and Joyce, 2002, Cleden 2009) claims that complexity is a factor that can limit a project; the bigger and more complex a project is, the more resources are required to complete it. Moreover, when all potential risks have been identified, the project team must remember that there might be more threats. Therefore, the project team should not solely focus on management of those identified risks but also be alert for any new potential risks, which might arise. RM should be used as a tool to discover the majority of risks and a project manager should be prepared for managing uncertainties not included in a RM plan (Cleden, D., 2009). This shows that the identified risks must not ready for political risks.

2.4. Benefits of Risk Management in Construction Projects

To maximize the efficiency of risk management, the Risk management process (RMP) should be continuously developed during the entire project. In this way, risks will be discovered and managed throughout all the phases (Smith et al. 2006). The benefits from RM are not only reserved for the project itself, but also for the actors involved. The main incentives are clear understanding and awareness of potential risks in the project. In other words, risk management contributes to a better view of possible consequences resulting from unmanaged risks and how to avoid them. (Thomas, 2009)

Another benefit of working with risk management is increased level of control over the whole project and more efficient problem solving processes which can be supported on more genuine basis. It results from an analysis of project conditions already in the beginning of the

project. (Perry, 1986) The risk management also provides a procedure, which can reduce possible and sudden surprises (Cooper et al. 2005).

Some of the benefits of risk management in road construction industry showed here under:

- Risk management contributes a better view of possible consequences resulting from unmanaged risks and how to avoid them (Thomas, 2009)
- Risk management increases the level of control over the whole project (Thomas, 2009)
- Provides more genuine bases on efficient problem solving processes as risk management results from an analysis of project conditions already in the beginning of the project (Perry, 1986)
- Risk management also provides a procedure, which can reduce possible and sudden surprises (Cooper et al. 2005).

2.5. Risk Management Process

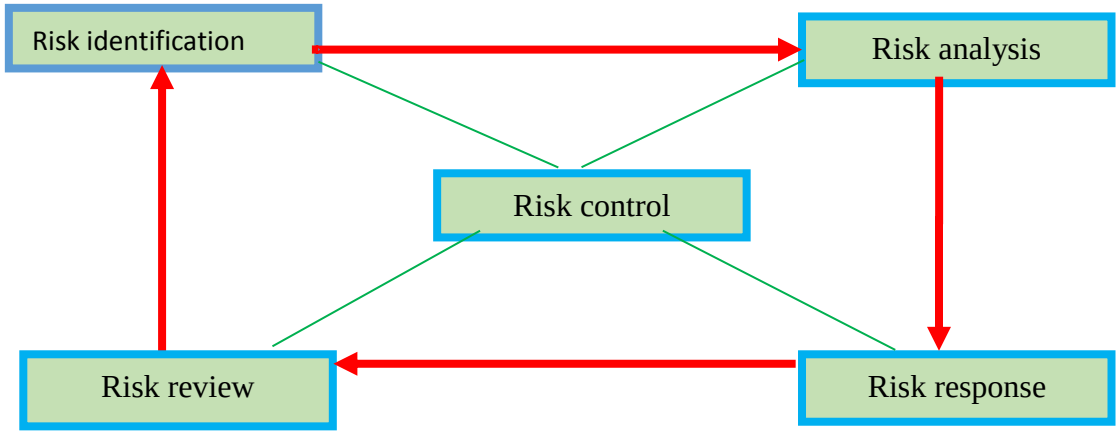

Figure 1. The Process of managing risks

Source (Smith et al. 2006)

2.5.1. Risk Identification

Risk identification is the process of identifying the risks that can adversely affect the project cost, schedule and the opportunities that can reduce project costs or result in reductionof project duration (Touran, 2006). The process of identification and analysis of risk should be continuous process from concept to operation phase of the project to maximize the risk

control mechanism of the project and ensure the completion of the project on time and budget. The result of this process will be recorded in the risk register for subsequent identification process (Asnake, 2010)

The objectives of risk identification are to identify and categorize risks that could affect the project and to document these risks and the outcome of risk identification is a list of risks (NCHRP, 2009). The main objective is to see that the major risks that could affect the project most adversely are not left unidentified. Most commonly a relatively small percentage of key risks are likely to account for the majority of the time and cost implications of the entire risk (Mead, 2007). Regarding Risk identification objective (NCHRP, 2009, Mead, 2007) elaborates in different methods

Analysis of prior projects the use of organizational charts to review internal structures and flowcharts to review process issues and through research, interviews, and surveys of parties likely to be impacted by the proposal (Mead, 2007). According to (Akintoye and MacLeod 1997), among the variety of the risk identification techniques checklists, brainstorming and flowcharts most commonly used in the road construction sector.

2.5.2. Risk analysis /assessment

Risk analysis is the second stage in the RMP where collected data about the potential risks are analyzed, involves quantifying the impact and the probability of occurrence of risks. After identification and classification of the probable risks, their impacts on the project objectives need to be assessed to develop proper response. Risk analysis can be described as short listing risks with the highest impact on the project, out of all threats mentioned in the identification phase (Cooper et al. 2005).

In the analysis of the identified risk, two categories of methods – qualitative and quantitative have been developed. The qualitative methods are most applicable when risks can be placed somewhere on a descriptive scale from high to low level. The quantitative methods are used to determine the probability and impact of the risks identified and is based on numeric estimations (Winch, 2002).

The main difference between qualitative and quantitative risk analysis is that the former uses a relative or descriptive scale to measure the probability of occurrence whereas quantitative analysis uses a numerical scale. For example, a qualitative analysis would use a scale of "Low, Medium, High" to indicate the likelihood of a risk event occurring, while A quantitative analysis will determine the probability of each risk event occurring. For example, Risk #1 has an 80% chance of occurring; Risk #2 has 27% chance of occurring, and so on.

The researcher will investigate if the risk analysis /assessment practices are underway in the Ethiopian road design and construction process

2.5.3. Risk response

This third step of the RMP indicates what action should be taken towards the identified risks and threats. The response strategy and approach chosen depend on the kind of risks concerned (Winch, 2002). Other requirements are that the risk needs to have a supervisor to monitor the development of the response, which will be agreed by the actors involved in this risk management process. (PMI, 2004, Winch 2002) claims that the lower impact the risk has, the better it can be managed. Most common strategies for risk response are: avoidance, reduction, transfer and retention (Potts, 2008). Beyond those types of responses, Winch (2002) describes that sometimes it is difficult to take decision based on too little information. This may be avoided by waiting until the appropriate information is available in order to deal with the risk. This way of acting is called "Delay the decision'' but this approach is not appropriate in all situations, especially when handling critical risks.

2.5.3.1. Risk Response Strategies on road Construction

Risk response development is a critical element in the risk management process that determines what action (if any) will be taken to address risks evaluated in the identification, qualification, and quantification efforts. Once the risks of the project have been identified and analyzed appropriate risk response strategy must be adopted in order to take the necessary steps to minimize the negative effects of risk on project objectives. Mead (2007) stressed that instead of simply pricing for risks, there are opportunities for mitigating risks

including: risk elimination (e.g. not proceeding or proceeding on a different basis); risk reduction (e.g. by undertaking further investigations/due diligence); risk transference (e.g. by legal, contractual and insurance); risk retention (e.g. self-insurance, bearing a large deductible, internal management of risk). Risk response occurs to eliminate, mitigate, deflect, or accept the risk and logically will reflect the cost benefit of the risk management process (Fewings, 2005).

Hillson (1999) had a different simplified approach, also listing four different strategies without differentiating between active and passive acceptance which include

- Avoid (seeking to eliminate uncertainty),
- Transfer (seeking to transfer ownership and/or liability to a third party),
- Mitigate (seeking to reduce the size of the risk exposure to below an acceptable threshold), or
- Accept (recognizing residual risks and devising responses to control and monitor them). No matter which response strategy is adopted, the aim is to adopt a proactive and effective manner to respond to the risk occurrence.

2.5.3.2. Risk Response Mechanism

a) Risk mitigation: It involves activities used to reduce the probability or impact of the risk. Risk reduction can be achieved through taking proactive action to reduce the negative effects of risk. Mitigation is action taken to reduce the risk and deflection is action taken to transfer the risk. They are not mutually exclusive, but deflection alone is not a way of reducing the probability. Mitigation may have the effect of reducing probability and impact (Fewings, 2005). According to Cooper (2005), mitigation strategies includes,

- Contingency planning;
- Quality assurance;
- Separation or relocation of activities and resources;
- Contract terms and conditions and
- Crisis management and disaster recovery plans.

b) Risk avoidance: Strategy for negative risks or threats that involves changing the project plan to eliminate the risk or to protect the project objectives (time, cost, scope, quality) from its impact (OSPMI, 2007). This can be achieved through activities including using suitable procurement option, change the method of execution etc. However, risk avoidance in construction is generally recognized to be impractical as it may lead to projects not going ahead or a contractor submitting an excessively high bid for a project (Akintoye, 1997).

c) Risk transfer:

It involves shifting the responsibility to respond for risk to another party who is in the better position to deal with it. Risk transfer is not aimed to eliminate or reduce risk. The transfer of risk can be achieved by using the relationship between client, contractor, subcontractor, and insurer. If more risk is allocated to the contractor, the greater the project cost as inflated amount of contingency budgeted for risk response by the contractor. Thus, transferring all the project risk to other party is not economical as the transferee may better manage some of the risks. As indicated by (Allen worth, 1996), There is variety of factors that should be considered when deciding who will bear particular project risk? These factors include,

- Who has the greatest amount of control over the risk; does anyone have specialized knowledge relevant to management of the risk?
- Who can best absorb the risk or spread it over the largest pool of transferees?
- Who will receive the greatest financial benefit from proper management of the risk?
- What are the statutory and common law limitations of risk transfer in the projects legal jurisdiction?
- What is the custom in the industry and does that custom make sense in this particular situation?
- What are the relative bargaining positions of the parties, including such factors as size, market conditions, and the parties' reputations for flexibility in contracting?

Many large-scale projects purchase insurance for risks ranging from theft to fire to transfer project risks and by doing so; the risk is effectively transferred to the insurance company in such a way that if a disaster occurs, the insurance company would be liable to pay the costs associated with the disaster. Insurance certainly is the most direct method of transferring risk;

however, there are other methods as well (Nadeem, 2010). For example, a fixed price contract with a contractor states that work will be done for a pre-specified amount. Fixed schedule can also be added to such a contract and penalties are imposed in case of overruns.

d) Risk retention: it involves activities used to absorb the effect of risk that have no significant effect and are repetitive can be effectively managed through retaining the responsibility by the owner of the project. There are two types of risk retention, i.e. passive retention and active retention (Rahman, 2013). Passive risk retention (sometimes called non-insurance), acknowledges the existence of risk without responding further and occurs through negligence, ignorance or absence of decision, e.g. a risk has not been identified and handling the consequences of that risk must be borne by the contractor performing the work. Active risk retention (sometimes referred to as self-insurance) is a deliberate management strategy after a conscious evaluation of the possible losses and costs of alternative ways of handling risks to allocate an essential allowance to support a contingency strategy for projects whenever necessary. Risk retention is a strategy that is adopted because it is either not possible to eliminate that risk from a project or the cost in time or money of the response is not warranted by the importance of the risk (OSPMI, 2007).

2.5.3.3. Risk Response under Performance Based Contracts (PBCs)

A variety of available metrics can measure project performance at construction completion. The metrics includes schedule, cost, quality, construction safety, levels of high-performance and sustainability including achievement of goals as they relate to the level of performance. Project delivery systems define major project participants' official involvement in the project, the level of integration, and contractual relationships between project parties (AIA-AGC 2004). Three types of project delivery systems have wide use in the DBB; DB; and CMR. Risk response strategies can be very different from one delivery system to another depending on the risk exposure and the uncertainty associated with the project.

The more uncertainty associated with the project, the more detailed and confrontational (Mills, 2001). Under PBCs, there are different factors that state this fact and make the contractor change strategy based on the delivery system characteristics, which are not limited to (Gruenberg et al., 2007): Longer commitment and liability period towards the project,

more risks allocated towards the contractor, longer time exposure to several risks including the maintenance period, fitness for purpose, and associated insurance risks, long-term cost increase and inflation through the performance period, resource availability issues.

2.6. Principles of Risk Allocation in Construction

The process of determining and allocating risk is fundamentally linked to the drafting of the conditions of contract, which is effectively the choice of standard form of conditions of contract and any amendments thereto (Premaraj, 2005). Whether the contract is for construction, construction engineering and inspection, design, design-build, or some other aspect of highway construction management, it defines the roles and responsibilities for risks. Risk allocation in any contract affects cost, time, quality, and the potential for disputes, delays, and claims (FHWA, 2006). Engineering and construction contracts incorporate specifications, drawings and schedules to communicate the objectives of the contract. The contract is the vehicle for risk allocation. Construction contracts deal with project risks through their allocation to the parties involved. The contract written agreement between client and contractor where the liabilities and responsibilities of each party are assigned. Knowing and have enough experience that can regulates contractual relationships or the selection of procurement option.

Procurement is defined under the proclamation or No. 430/2005 of the Federal Democratic Republic of Ethiopia as the purchasing, hiring, or obtaining by any other contractual means of goods works and services. Whereas concerning to construction, procurement is also expressed as a process used to select the lowest competitive and qualified bidder for procuring services or works or goods from potential competition based on reasonable relevant criteria. (Wubishet J., 2006, Lecture note)

An appropriate allocation of risks between actors in a construction project is important because it is impossible to eliminate all potential risks. Risk allocation influences the behavior of project actors and, therefore, has a significant impact on the project performance in terms of the total cost.

One of the main problems identified in the literature is the actors' different perceptions of to whom a specific risk or group of risks should be allocated. Usually, contractors indicate that

they have to bear the majority of project risks (Andi 2006). This leads to an increasing number of disputes between the parties during project execution. A study by Zaghloul and Hartman (2003) shows a significant relation between risk allocation and trust.

Trustful relationships between project actors result in a more effective risk allocation process, decrease of contingency funds and, finally, in project cost reduction. Before proceeding with a project, a client has to choose an appropriate procurement option that facilitates an effective project organization in general and a thorough risk management process in particular. By identifying three procurement variables that have a major influence on risk management:

From the perspective of design responsibility there are two major methods of project delivery: in general contracts responsibility for design lies with client while in design-build contracts design responsibility lies with contractor. As design is considered to be a significant source of risk (Akintoye et al., 1997), responsibility for design may influence actors' attitudes towards RM.

2.6.1. Design-bid-build contracts

Design-bid-build contracts are contracts where the client is responsible for the planning, design and function of a construction and the contractor is responsible for the job execution. Within this contract form, two main organizational alternatives are possible: divided contracts and general contracts. A divided contract implies that the client appoints several contractors and signs a separate contract with each contractor. This form allows the client to choose the best possible tender for every part of the work. On the other hand, the coordination costs are very high and it might be difficult to identify exactly which contractor is responsible for a particular error. A general contract implies that a client signs only one contract with a general contractor, who in turn appoints subcontractors to carry out the work. The general contractor is solely responsible for the coordination of subcontractors. In the case where a design-build contract is used, contractors increase their price to include insurance for the extra risks involved. Öztas and Ökmen (2004)

2.6.2. Design-build contracts

In design-build contracts the contractor is responsible for both design and construction. The client signs only one contract, thus this type of contract is the most straightforward from the perspective of responsibility. In the procurement documentation, the clients set their demands in terms of functionality. Öztas and Ökmen (2004)

From the risk management perspective, design-build contracts are more attractive for the client as the responsibility for design implies that more risk is allocated to the contractor. On the other hand, the design-build alternative may be more expensive compared with design-bid-build contracts. Tre researcher agrees with such practice will evaluate such circumstance is exists.

Furthermore, the quality of the final product may be lower if the contractor uses cheaper solutions, trying to decrease the risk on his own costs. This problem is especially relevant in contracts with a lump sum payment mechanism. In terms of time, the design build system arguably provides an earlier start of the project execution than is the case for other forms. (Toolanen ,2004) found that clients choose design-build contracts more often when the project's timeframe and availability of resources are critical factors. From the contractor's point of view, design-build construction projects could be very risky when the contractor lacks knowledge and experience of the design-build system. Håkansson et al. (2007) highlight that the competence requirements are higher in design-build contracts and hence structured risk analysis should be made very early in the project.

The process of determining and allocating risk is fundamentally linked to the drafting of the conditions of contract, which is effectively the choice of standard form of conditions of contract and any amendments thereto (Premaraj, 2005). Whether the contract is for construction, construction engineering and inspection, design, design-build, or some other aspect of highway construction management, it defines the roles and responsibilities for risks. Risk allocation in any contract affects cost, time, quality, and the potential for disputes, delays, and claims (FHWA, 2006). Engineeringand construction contracts incorporate specifications, drawings and schedules to communicate the objectives of the contract. The contract is the vehicle for risk allocation. According to (Bunni, 2003), the allocation of risks

between the contracting parties in a construction contract is one of four criteria usually applied for the choice of the type of contract conditions to be used. The other three are;

- The allocation of functions that exist in the construction process;
- The choice of the preferred method of remuneration; and
- The allocation of the management functions

The objectives of risk allocation can vary depending on unique project goals, but the four fundamental tenets of sound risk allocation should always be followed (FHWA, 2006):

- Allocate risks to the party best able to manage them.
- Allocate the risk in alignment with project goals.
- Share risk when appropriate to accomplish project goals.
- Finally seek to allocate risks to promote team alignment with customer-oriented performance goals.

2.7. Risk review

This fourth step of RMP is vital since all information about the identified risks is collected, and monitored (Winch, 2002). The continuous supervision over the RMP helps to discover new risks, keep track of identified risks and eliminate past risks from the risk assessment and project (PMI, 2004). It also states that the assumptions for monitoring and controlling are to supervise the status of the risks and take corrective actions if needed. By managing the whole RMP, the process can be evaluated. This is a method of creating a risk register where all risks and their management can be allocated in order to facilitate future projects (PMI, 2004). This is also a way to improve the project work, since the advantages and disadvantages will be brought up.

2.7.1. Risk Monitoring and Control on Road Construction

Risk monitoring is the final stage of risk management cycle. The major role of risk monitoring is to ensure the effectiveness of the risk management system including identification; analysis and response are applied to the project (IRM, 2002). Risk monitoring system is required to maximize the effectiveness of risk response towards meeting the project objectives. Risk monitoring process also used to indicate the need for revision of cost and program in relation to the response for risk (ERA-SMEC, 2008). Another important aspect of

risk monitoring is to ensure that actual events are recorded for use in future projects. Risk register is used as a record system in which the information including the identified risks and the proposed strategy as well as its result should be recorded for use of subsequent risk management activities and further actions.

Risk monitoring and control involves implementing the risk plan, which should be an integral part of the project plan. Two key challenges are associated with monitoring and control.

- The first is putting the risk plans into action and ensuring that the plans are still valid.
- The second is generating meaningful documentation to support the process.

IRM (2002), suggested that any monitoring and review process should also determine whether: The measures adopted resulted in what was intended the procedures adopted and information gathered for undertaking the assessment were appropriate; improved knowledge would have helped to reach better decisions and identify what lessons could be learned for future assessments and management of risks.

2.7.2. Tools and techniques used for risk monitor and control

- Risk re assessment – identification of new potential risks. This is a constantly repeated process throughout the whole project.
- Monitoring of the overall project status – are there any changes in the project that can affect and cause new possible risks.
- Status meetings discussions with risk's owner share experience and helping managing the risks.
- Risk register updates

2.8. Sources of risk on Road construction

There are several approaches to categorizing project risks and risk sources (Jaafari 2001). In general, the sources of risk in construction projects may be divided into three groups:

- Internal or controllable risks (e.g. design, construction, management and relationships);
- External or uncontrollable risks (e.g. financial, economic, political, legal and environmental);

- Force majeure risks,

2.8.1. Construction Risk Factors

The construction industry is a vehicle through which a nation's physical developments are activated by initiating projects from the blue print stage to the implementation. However, the phases of a project have greater tendencies to exhibit risk occurrence as results of unforeseen and uncertain events. Over the decades, there are a number of delayed or postponed large-scale projects around the world due to unexpected risks and uncertainties. Risks on road construction projects can be divided into four levels; national/regional, Road construction industry, Company and Project.

There are a few risk categories in construction project that include commercial risk, operational & maintenance risk, design risk, construction risk as well as financial risk. Most of these risks could be identified, quantified, mitigated, and prioritized in order to minimize their consequences and impacts on a particular project. These processes, which involved the identification of risk, analysis of the implications, response to minimize risk and allocation to appropriate contingencies, are known as risk management (Wang et.al, 2013).

2.8.2. Risk Classification in Construction

Risk classification is a significant step in the risk management process, as it attempts to structure the diverse risks affecting a construction project. There are many approaches in literature for construction risk classification. Owing to the various natures of risks, which may be encountered in a major project and the differing weights, which may attach to their consequences; it is not uncommon for parties to seek to identify these risks under major headings or categories (Mead, 2007).

Baloi (2012) suggested risk classification based on the structure of the environment surrounding a project or organization by dividing into three distinct layers: Outer layer or general environment; Operational environment; and Inner layer or internal environment

Both the general and operational environments can be considered external environments. The general environment comprises domains that are broad in scope and have little immediate and direct impact on the organization's activities. The general environment comprises five

basic elements or domains, namely Economic environment, Political environment, Social environment, Technological environment and physical or natural environment.

The operating environment is the external environment comprising factors that have more specific and immediate impact on the organization or project. These factors include suppliers, clients, sub-contractors, consultants, and competitors. Finally, the internal environment is the inside environment that has direct, close, and immediate impact on the organization. The internal environment is basically concerned with organization's resources, which include financial, physical, human, and technological resources, as well as managerial values and ethics. In this context, opportunities and threats/constraints from the external environment and strengths and weaknesses/constraints from the internal environment are strongly related to risks.

Bunni (2003) has also classified risks in chronological manner that affect, in principle, the construction trinity of owner, professional team, contractor and in certain circumstances the community at large as risks with the feasibility stage, risks with the design stage, risks with the construction stage and risks with the post-construction stage as enumerated.

- Risks which are associated with the feasibility stage are Owner's choice of professional team and advisers; Owner's brief to the professional team; choice of site; adequacy of soil investigations; adequacy of surveys and inspections;
- Risks which associated with the design stage are; inappropriate choice of design with respect to others and society; negligence and lack of care; State of the art; codes and technical knowledge;
- Lack of knowledge, inadequate checking and work carried out in haste; lack of communication, failure to take account of foreseeable problems, use of untested and unproven techniques, inadequate performance of mechanical and electronic equipment, lack of safety precautions, choice of contractor and nominated subcontractors.
- Risks which are associated with the post-construction stage are; risks associated with safety; associated with serviceability; associated with fatigue; associated with fire and arson; acts of God in relation to nature of site topography and surface water run-off;

risks associated with natural hazards; when risks of natural hazards are added to human mistakes; and risks associated with man-made hazards, including political risks; risks associated with fitness for purpose; risks associated with project operation; risks associated with wear and tear during the project's designed life span.

Bunni (2003) further identified a group of risks connected with the political, financial, and sociological and status of the country in which the site is located. They can be enumerated as external stability of government; political risks; internal stability of government; financial stability and economic risks; official procedure (formalities); transit to site and condition of infrastructure; taxes; and legislation and stability of the legal system. Nadeem (2010) classified risks as technical, operational or business aspects of projects; acceptable or unacceptable; manageable and unmanageable.

It is suggested that it is wise for each of the participants to consider each risk, which they identify as being relevant to the project as a whole. Thereafter seek to categorize those risks by the manner in which they are proposed to be "treated", rather than seeking to "fit" risks into general categories or even more alarmingly seek to allocate them at the outset to the respective parties as matters of concern for the other project participants (Mead, 2007).

2.9. Risk Management Model of Road Construction Projects Using (WBS) and (RBS)

Modern construction projects in nature do not allow uncertain factors and risks depending on the experiences and intuition of the contractors and project owners. Because of this, the necessity of risk management is getting increased on road construction industry and contractors are paying more attention to the methods and procedures to manage risks systematically. In particular, they are realizing that they can maximize profits only when they can identify and analyze the risks not after but before happening.

There are not many established studies regarding the construction of computer system for risk management in construction industry. However, it is a very important in construction management and it is really an active construction project management method to identify and remove the risk factors before dangerous situations are actually made. As there are many

risk factors and uncertainties in construction projects, contractors should have appropriate management and analysis process to manage and respond to them (Sang Yun Jung, 1998).

2.9.1 Overview of construction Risk Management System (CRMS)

The most emphasized factor in this model is the risk identification. The most important thing of the risk management is how easily and accurately it can identify the risk factors that are scattered inside and outside of the project. Checklists comprising with phased project evaluation system were used to identify risks. In particular, if the checklists that are pre-designated to evaluate local and foreign environments and can be easily ignored by project managers are checked thoroughly, project exterior environments can be evaluated.

They are called Global Risks. CRMS provides good communication between field sites and headquarter using web-based architecture. It is structured to deal with current situation of the project, quality control and cost management concurrently by identifying global and local risk factors based on checklists. Additionally, it can be used as basic materials for construction management because it allows us to identify construction status and risk factors by construction type by connecting the construction type oriented local risks with WBS.
The purpose of web based CRMS development is to allow real time communication between fields and headquarter (H.M. Tah&V. Carr2000).
The model of phased CRMS composed of the following 5 procedures.

- Phased model composition of CRMS
- Project Information Phase Model
- Risk Identification Phase Model
- Fuzzy Risk Analysis Phase Model
- Risk Action Phase Model
- Risk Report Phase Model
- The phased information flow of CRMS

In the project planning phase, local and overseas environments are evaluated according to the preset evaluation system. This evaluation is performed by risk analyst and corresponding project manager. This process is composed of the processes to help project managers to

understand localand overseas construction environments systematically. After the project is evaluated through checklists, identified global risks are entered and the analysis is performed. In case of local risks at the construction phase, WBS is constructed and then local risk factors connected with WBS in each process are identified. The identified risks were screened to identify core risk factors and prioritize them through setting weight and performing fuzzy evaluation. Lastly countermeasures can be developed, if needed.

2.9.2 Purpose of Risk Identification in Construction

Risk identification is very important process to identify the risk factors related to a certain construction project, to classify them systematically according to standards and to select the core risk factors that should be mainly considered in risk analysis stage. In this study, focusedarea should be on how to perform risk factor identification most efficiently. If risks are not identified in this stage, the next processes are meaningless. Even though having the best analysis system, it cannot make big influence on the project, if it fails to identify risk factors in this stage. Risk identification in this study is based on the subjective judgment of checklist analysts and experts who compose each evaluation system.

2.9.3 Risk Identification Procedure

In this study, information flow was analyzed to construct computing system and the result of the analysis is the risk identification process that identifies local risks connecting with WBS. In case of local risks, it would be the most proper to identify risk factors using visualized WBS.

2.9.3.1Connection between WBS and RBS

In order to make integrated management and analysis of WBS and RBS in risk identification stage, a code system was developed and WBS and RBS were integrated.

When looking into the code system of WBS, facility classification code can be classified into by functional and by style. WBS code has 4 step classifications

- Facility classification Code,
- Space Classification Code,
- Part classification code and

- Element Classification Code. WBS automatically using WBS generator, this WBS code linked 4D CAD and RBS, so risk analyzer can identify visually risks to may exist in work items. The researcher will check if such practices acknowledge.

2.9.4 Risk Analysis Model

The composition of risk analysis model is once data entry is done through data collection and evaluation in risk identification stage, provisional evaluation on the risks is performed as the next course. Provisional evaluation is performed by risk data identified during the risk identification process, cost and schedule information, WBS and subjective management of experts.

This course is to save time and money necessary for risk analysis and it selectively classifies risk factors identified by judgment of experts before full-scale risk management.

Unmanageable risks are composed of force majeure risks, contingent risks due to carelessness and unexpected risks during the construction process. These risks pass over risk analysis stage and qualitative analysis is made using fuzzy analysis. If the risks are manageable, they are the risks related to past records or empirical and subjective judgment of field experts. They go directly to risk response stage not going through the risk analysis process and countermeasure are sought after to deal with the identified risks. Unmanageable risks are quantified through language variance of the experts and then risk level and priority are determined. Based on these result values, countermeasures against the risk factors will be established and managed. These risk analysis processes are not performed through one time execution but they are analyzed and managed in a continuous feedback cycle.

2.9.5 Fuzzy Analysis Procedure of CRMS

In order to perform fuzzy analysis, we need to preset membership function values using trapezoid function and enter those values. The preset entry items are membership function values and fuzzy number of language variable group regarding the danger value. Users are not required to enter these values. These values are set by experts who have experiences and expertise in fuzzy theory. They will modify the value after comparing with other records after judgment. It is allowed to change the membership function value because subjective

judgment on a certain risk can be different and every project has different project environments.

However, general users do not need to enter those values at all. Once they enter occurrence rate and risk intensity, the danger level and priority can be analyzed.

2.9.6 Risk Response Model

Once risk analysis is done, we need to seek for countermeasures. Before identifying countermeasures, we need to identify causes of the risks. For this procedure, CRMS made users record major causes. The procedures of risk response model show how to deal with unmanageable risks and manageable risks by establishing countermeasures.

2.9.7 Risk Response Procedure.

Risk countermeasures are established based on the risk evaluation and review process result of the risk analysis model. Risk response countermeasures are made based on the results established through the evaluation and review process of the risk analysis model. In the risk response model, countermeasures are established by integrating and interpreting all the materials analyzed previously.

They are required to be entered through the subjective judgment of the users and the reference to the previous records. It comprises response cost, response schedule (construction period), preventive phase, contingency phase and other corrective actions. Risk response model is to establish countermeasures based on the results of risk evaluation through fuzzy analysis. The countermeasures are to be established to have preventive phase, contingency phase and final practice phase. Other items to be entered are risk response cost/ construction period, and people responsible for countermeasure establishment and execution.

2.9.8 Risk Report Model

Risk report model which is the final execution stage of CRMS is to identify comprehensive outputs of the previous phased model and to prepare the report that can manage them. All data regarding risk identification, analysis result and risk response are integrated and summarized through fixed report forms. The procedures of the risk report model are

composed in CRMS and it is possible to distinguish risk values by risk management phase and enter them according to their category.

2.9.9 Risk Report Procedure

This report system is configured to enable the integrated results of the risks to be confirmed. The report items include project information related, WBS and RBS related, project review standards and overall risk management materials.

2.10.Road Construction Industry in Ethiopia

The Ethiopian Roads Authority (ERA) administrates the road construction industry is the largest road construction employer in the country. There are number of local and foreign contractors and consultants participating in design, construction, and maintenance of road projects. However, in the area of Construction Industry in Ethiopia is not researched enough and hence it is difficult to get sufficient literature to give concrete information. However, Ethiopia, being the least developing country, and few studies made (SMEC 1999 EACE 2003) indicates Ethiopia it shares most of the common characteristics of the Construction Industry experiential in other developing countries.

According to Wubishet,2004, the level of Performances in the Public Construction Projects in Developing Countries- the Case in Ethiopia is described that modern Construction Industry in Ethiopia started during the reign of Emperor Minilik II who is well known for the Government of the Modern Ethiopian State. at that time, Asphalt Road constructed from Addis Ababa to Asmara (Wubishet, 2004). It described that Italy during its invasion (1936-

1941), had contributed for the development of Construction Industry, especially on the road sector in which case about 6000 km road networks constructed. (A special Publication for a memorial Golden Jubilee, ERA, 2001; Wubishet, 2004).

Table1: The Development of Construction Industry in Ethiopian

Table 1 below presents the development of construction industry in Ethiopian

No	Period	Remark
1	Pre-1968	• Foreign companies dominated the industry • Ministry of Public Works (MoPW) and the Imperial Highway Authority (IHA-1951) were established • Alemgena Training Center established in1956 being the first to train qualified professionals • Schools were constructed by the donation of IDA and SIDA
2	1991-2001	• Small- scale construction companies BERTA P.L.C, National Engineers and Contractors P.L.C, Ethiopian Building and Road Construction (ETBuRC) were flourished
3	1982- 1987	• The Socialist Command Economy policy confiscates the development of the pr local private construction companies. • Construction companies were monopolized by the State.
4	1987-1991	• Policy change from Command Economy to Mixed Economy • Fragmentation between Design and Construction • Consultant offices were established for the design and contract administrations. • Small- scale private contractors and consultants emerged again.
5	1991-2001	• The change in Government introduced Market- Based Economic policy. • Decentralization and some important policies for the industry were resulted • MoFED is established to help the industry in strategies and standard issuance Standards, Codes for the national construction are issued. • Registration and licenses are provided to contractors and consultants.
6	2001- 2004 *	• Following the effectiveness of Proclamation No. 256/2001 different changes were introduced and institutions were established to help the industry, including MoCB, Road Fund,

2.11. Capacity of the construction industry in Ethiopia

The study by Siemens manufacturing and Engineering Center (SMEC) concluded that the general state of the industry is very low (SMEC, 2000). This current status of the industry is resulted from the past economic policies in which the industry was not considered as an

independent sector. And the following features characterize the National Construction Industry,

Lack of clear economic objectives for the industry; Inadequate coordination of planning between the industry and the infrastructure programs in the various sectors of the economy heavily dependence on foreign resources such as equipment, materials and expertise to be supplied by foreign contractors and consultants; transportation problems for the distribution of construction materials and equipment; irrelevant local construction standards, and regulation; inadequate and ineffective organizations representing the interests of contractors, consultants. And unnamed factors.

This makelocal construction companies to be deficient to meet the needs, and uncompetitive with their international counterparts. The standard level of the industry in Ethiopia, like the other developing countries also may arise from:

- Constraints with regard to the development of private sectors in the area.
- Low awareness of governments in the developing countries with the benefits of the capable Local Construction Companies.
- Fragmentation and compartmentalization of the Construction Industry. (Wubishet, 2003)

The study of Wubishet while assessing the capacity of the local construction industry o the country identified various problems in relation to scarcity of materials, weak organizations and poor information management system. (Wubishet, 2004) according to his study, almost all resources in the country are scares. Besides, finance, machinery and technology are highly dependent on foreign sources and there is also inappropriate perception and policies together with huge foreign dependencies worsen the scarcity.

Stakeholders of road sector also described in the consultative meeting held among them through ERA that finance is the basic problem of the industry, especially for local contractors in the sector. The described financial incapability with respect to the problems associated that inaccessibility of construction equipment and machineries and the amounts of contract

guarantees. Because financial institutions are not capable to support the industry and there is no culture of working and growing together in local contractors.

The Local Construction Industry and specifically project owners and providers found in the study lacking capability and professional practitioners. The study indicated that human resources in contract administration, project planning and design checking capabilities specifically deficient in the area and described that the workmanship in the area is developed through experience than skill-based training. (Wubishet, 2004)

2.12. Participation of Local Contractors in Road Projects

The transformation of economic policy in 1992 encourages the participation of private contractors in construction sector. Hence, many construction firms established in response to imitative government policy even if their numbers and organizational size is small as compared to other developing countries. (ERA ,2005)

During the first phase of RSDP (Road Sector Development Program), the participation of local contractors has been amounted to 20%of total contracts for Federal Road rehabilitation, upgrading and construction projects. Whereas International contractors have taken up the lion share of 70% of the total contract while force account has taking the rest of 10%of total contracts (RSDP assessment report). Hence based on the first phase of RSDP report, enhancing the local construction has been identified as important aspect of ensuring the sustainability of road network.

Furthermore, in second phase of RSDP, more emphasis was given to further enhance the capacity of private local contractors. Specific activities being introduced in RSDP II to assist these contractors through training and procurement programs. The use of long-term level-of-service maintenance capacity of contracts considered as these contracts can provide emerging firms with suitable continuity of work to finance equipment purchase. Currently, further measures taken to strengthen the private contracting sector. These include enhancing the development of local contractors by offering training, and involving them more in road works contracts also by reforming the contract documents of Government financed projects as required, and facilitating the establishment of equipment leasing companies. In response

to these measures, the participation of local contractors is increasing from time to time. For instance, the participation of local contractor in first phase is exceedingly more than in the second phase of RSDP.

2.13. The Progress of RSDP In the Ethiopian Roads Authority (ERA)

The Ethiopian Roads Authority (ERA) administrates the road construction industry and is the largest road construction employer in the country. There are number of local and foreign contractors and consultants participating in design, construction, and maintenance of road projects. The foreign contractors are the major implementer of road sector development program during the first phase of the RSDP Program (1997 – 2002). However, the local firms have shown involvement from second to fourth phases of the program (2002-2015) and as result the construction industry as well as the capacity of local firms has been considerably improved both financially and technically (ERA, 2013).

2.14. Overall performance in road sector development

The eighteen years' performance of RSDP brought significant improvements in the restoration and expansion of Ethiopia's road network. Physical achievements matched with significant improvements in the condition of the network, strengthening of the management capacity of the road agencies and delivery on policy reform. A total of 118,553 km of major physical road works excluding routine maintenance were carried out of which 31,821kmconstructed were federal roads**,** 24,319km regional roads found and 62,413kmURRAP roads built. Overall, physical accomplishment against plan was 92%. Total disbursement about ETB 218.7 billion and this disbursement is118% of the plan.

With regard to federal roads, 2,865 km of rehabilitation of trunk roads and 9,472 km of upgrading of trunk link roads and 7038 km construction of new link roads carried out under the program. In parallel with this, heavy maintenance on 12,446 km of federal road also carried out. The following table illustrates different aspects of performed in RSDP I-V and 18 years' performance in the road sector development.

Table 2: Financing Pattern of RSDP (in million ETB)

Table 2 presents local and external sources of finance for Road Sector Development Plane

Phase of RSDP	Financing from Local Sources		Financing from External Sources		Total	Total Percentage
	Amount	Percentage	Amount	Percentage	(in million ETB)	%
RSDP I	4,433.7	61	2,850.9	39	**7,284.6**	**100**
RSDP II	12,110.1	67	6,002.7	33	**18,112.8**	**100**
RSDP III	26,068.4	75	8,889.4	25	**34,957.9**	**100**
RSDP IV	**131,539.6**	**83**	**26,793.7**	**17**	**158,333.3**	**100**
Total	**174,151.8**	**80**	**44,536.8**	**20**	**218,688.6**	**100**

Source 18 years ERA report

2.14.1. Performance of RSDP I

During RSDP I, a total of 8709 km of roads were rehabilitated, upgraded, constructed and maintained of which 2709 km of roads were federal roads, 6000 km were regional roads. During RSDP I, ETB 7.3 billion were disbursed of which 5.5 billion on federal roads and ETB 1.7 billion for regional roads. With regard to the federal road network, 975 km of trunk roads rehabilitated, 549 km of trunk and link roads upgraded and 928 km of new link roads constructed during RSDP I. parallel to these works, a total of 257 km of heavy/emergency maintenance work carried out on federal paved and gravel roads. Physical and Financial performance against plan during RSDP I is 72% and 79% respectively. In addition, detailed design studies, design reviews, feasibility studies undertaken for number of pipeline road projects.

By the end of RSDP I, in 2002 achievements registered in improving rural accessibility and condition of the road network. The road network of the country increased to 33,297 km in

year 2002 from 26550 km in year 1997. As result, Road density per 1000 sq. km increased to 30.3 km in year 2002 from 24.1 km in year 1997. The proportion of the road network in good condition increased to 30 % in year 2002 from 22% in 1997.

Table 3: Summary of Accomplishment for RSDP I

Length in km, Budget & Disbursement in million ETB

Item No.	Project	RSDP I, 5 Years					
		Physical			Financial		
		Plan	Acco.	%	Budget	Disbu.	%
I.	**Federal Roads**						
1.1	Rehabilitation of Trunk Roads	1259	975	77	3161.4	2543.3	80
1.2	Upgrading of Trunk Roads	822	540	66	1332.9	894.0	67
1.3	Upgrading of Link Roads	0	9		200.1	176.7	88
1.4	Construction of Link Roads	930	928	100	768.8	878.1	114
1.5	Heavy/Emergency Maintenance	766	257	34	313.8	92.1	29
1.6	Routine Maintenance				701.0	676.2	97
1.7	Feasibility & EIA Study				15.6	5.5	35
1.8	Procurement of Equipment and Spare Parts				304.2		
1.9	Bridge & Structures Maintenance & construction				63.6	32.6	51
1.10	Policy and Capacity Building				156	129.9	83
1.11	Recurrent Expenditure					96.4	
	Sub – Total	**3777**	**2709**	**72**	**7017.4**	**5524.8**	**79**

Source 18 years ERA report

2.14.2. Performance of RSDP II

During RSDP II, a total of 11,589 km of roads rehabilitated, upgraded, constructed and maintained of which 7483 km of roads for federal roads, 4106 km of roads for regional roads. During RSDP II, ETB 18.1 billion disbursed of which 14.7 billion for federal roads and ETB 1.8 billion for regional roads.

With regard to the federal road network, 970 km of trunk roads rehabilitated, 1,702 km of trunk and link roads upgraded and 612 km of link roads constructed during RSDP II. In parallel to these works, total 4,199 km of heavy/emergency maintenance work carried out for federal paved and gravel roads.

RRAs managed to construct 4106 km of rural roads, disbursing around ETB 1.8 billion. In addition, 58,114 km of community roads constructed by Woredas, with an expenditure of ETB 1.4 billion. Table 4 provides a summary of the accomplishment of the RSDP II.

Physical and Financial performance against plan during RSDP II was 140% and 113% respectively. Performance of RSDP II was remarkable as physical performance was much higher than plan and financial performance was also higher than plan.

By the end of RSDP II, in 2007achievements registered in improving rural accessibility and condition of the road network. The road network of the country increased to 42,429 km in year 2007 from 33,297 km in year 2002. As a result, Road density per 1000 sq. km increased to 38 km in year 2007 from 30km in year 2002. The proportion of the road network in good condition increased to 49 % in year 2007 from 30% in year 2002.

Table 4: Summary of Accomplishment of RSDP II

Length in km, Budget & Disbursement in million ETB

Item No.	Project	RSDP II, 5 Years					
		Physical			Financial		
		Plan	Acco.	%	Budget	Disbu.	%
I.	**Federal Roads**						
1.1	Rehabilitation of Trunk Roads	741	970	132	2221.5	3384.8	152
1.2	Upgrading of Trunk Roads	1163	1413	121	3726.1	4913.4	132
1.3	Upgrading of Link Roads	295	289	98	1365.5	1414.4	104
1.4	Construction of Link Roads	662	612	92	2292.3	1919.7	84
1.5	Heavy/Emergency Maintenance	2514	4199	167	831.4	1398.6	168
1.6	Routine Maintenance				606.1	848.3	140
1.7	Feasibility & EIA Study				25.6	41.2	161
1.8	Procurement of Equipment and Spare Parts				41.2	208.1	505
1.9	Bridge & Structures Maintenance & construction				116.7	121.3	104
1.10	Policy and Capacity Building				363.7	295.7	81
1.11	Recurrent Expenditure				118.8	142.5	120
	Sub – Total	***5375***	***7483***	***139***	***11708.9***	***14688.0***	***125***

Source 18 years ERA report

2.14.3. Performance of RSDP III

During RSDP III, a total of 12,395 km of roads rehabilitated, upgraded, constructed and maintained of which 7996 km of roads for federal roads, 4399 km of roads regional roads. During RSDP III, ETB 34.9 billion disbursed of which 31.4 billion for federal roads and ETB 2.4 billion for regional roads.

With regard to the federal road network, 344 km of trunk roads rehabilitated, 2,723 km of trunk and link roads upgraded and 1603 km of link roads constructed during RSDP III.

In parallel to these works, a total of 3,326 km of heavy maintenance work carried out on federal paved and gravel roads. RRAs managed to construct 4399 km of rural roads, disbursing around ETB 2.4 billion. In addition, 42,270 km of community roads constructed by Woredas, with an expenditure of ETB 0.9 billion. Table 8 provides a summary of the accomplishment of the RSDP III. Overall physical and financial performance against plan during RSDP III was 84% and 101% respectively.

By the end of RSDP III, in 2010 achievements registered in improving rural accessibility and condition of the road network. The road network of the country increased to 48,793 km in year 2010 from 42,429 km in year 2007. As result, Road density per 1000 sq. km increased to 44.4 km in year 2010 from 38.6km in year 2007. The proportion of the road network in good condition increased to 56 % in year 2010 from 49% in year 2007.

Table 5: Summary of Accomplishment of RSDP III

Length in km, Budget & Disbursement in million ETB

Item No.	Project	RSDP III, 3 Years					
		Physical			Financial		
		Plan	Acco.	%	Budget	Disbu.	%
I.	**Federal Roads**						
1.1	Rehabilitation of Trunk Roads	354	344	97	3643.3	6115.2	168
1.2	Upgrading of Trunk Roads	1547	1082	70	6224.7	6123.0	98
1.3	Upgrading of Link Roads	1968	1641	83	8255.0	8570.3	104
1.4	Construction of Link Roads	1980	1603	81	7760.8	6264.0	81
1.5	Heavy/Emergency Maintenance	3108	3326	107	2574.7	2218.5	86
1.6	Routine Maintenance				750.0	1369.8	183
1.7	Feasibility & EIA Study					4.1	
1.8	Procurement of Equipment and Spare Parts					16.7	
1.9	Bridge & Structures Maintenance & construction				135.0	183.4	136
1.10	Policy and Capacity Building				109.7	383.3	349
1.11	Recurrent Expenditure				96.0	190.9	199
	Sub – Total	**8956**	**7996**	**89**	**29549.2**	**31439.2**	**106**
II.	**Regional Roads**						
2.1	Construction of Rural Roads & Bridges	5730	4399	77	2865.0	1759.3	61
2.2	Maintenance				450.0	439.0	98
2.3	Recurrent Budget				340.0	188.2	55
	Sub – Total	**5730**	**4399**	**77**	**3655.0**	**2386.5**	**65**

Source 18 years ERA report

Table 6: Summary of Accomplishment for RSDP IV (5 years)

Length in km, Budget and Disbursement in million ETB

Type of Work	RSDP IV five years			RSDP IV five years		
	Planned	**Actual**	**% age**	**Budget**	**Disb.**	**% age**
A. Federal Roads						
Rehabilitation of Trunk Roads	728	575	**79**	4757.8	4757.8	**143**
Upgrading of Trunk Roads	1089	1268	**116**	8541.5	15432.3	**181**
Upgrading of Link Roads	3,934	3232	**82**	26029.8	34735.5	**133**
Construction of New Link Roads	4331	3894	**90**	35078.9	54589.8	**156**
Periodic Maintenance	4700	4664	**99**	4636.3	2056.7	**44**
Performance Based Maintenance				931.2	73.4	**8**
Routine Maintenance				2700.0	2370.3	**88**
Others				2941.9	3873.1	**132**
Sub Total	***14,782***	***13,633***	***92***	***84186.8***	***117888.8***	***128***
B. Regional Roads						
Construction	11212	9814	87.5	13341.8	10765.5	**81**
Maintenance				1049.9	1433.0	**136**
Sub Total	***11,212***	***9814***	***87.5***	***14391.7***	***12198.6***	***85***

Source 18 years ERA report

2.14.4 Overall Performance of RSDP

The eighteen years' performance of RSDP brought significant improvements in the restoration and expansion of Ethiopia's road network. Physical achievements matched by significant improvements in the condition of the network, strengthening of the management capacity of the road agencies and delivery on policy reform. A total of **118,553 km** of major physical road works excluding routine maintenance carried out of which **31,821km**for federal roads**, 24,319km**for regional roads construction and **62,413km** URRAP roads.

Overall physical accomplishment against plan was **92%**. Total disbursement about ETB **218.7 billion** and this disbursement 118**%** of the plan.

With regard to federal roads**, 2,865 km** of rehabilitation of trunk roads and **9,472 km** of upgrading of trunk and link roads and **7038 km** construction of new link roads carried out under the program. In parallel with this, heavy maintenance on **12,446 km** of federal road also carried out. Table 10 shows summary of performance of RSDP over the past eighteen years.

Table 7: Summary of Accomplishment of 18 years of RSDP

Length in km, Budget & Disbursement in million ETB

Total RSDP 18 yrs.						
Type of Work	**Planned**	**Actual**	**% age**	**Budget**	**Disb.**	**% age**
A. Federal Roads						
Rehabilitation of Trunk Roads	3082	2865	**93**	12353.5	15548.3	**126**
Upgrading of Trunk Roads	4621	4302	**93**	19825.2	27362.8	**138**
Upgrading of Link Roads	6197	5170	**83**	35850.3	44896.9	**125**
Construction of New Link Roads	7903	7038	**89**	45900.8	64904.3	**141**
Federal Roads Periodic Maintenance	11088	12446	**112**	8356.2	5765.9	**69**
Performance based Maintenance	0	0		4757.1	5264.5	**111**
Routine Maintenance	0	0		931.2	73.4	**8**

(continued)

Others				4488.0	5724.6	**128**
Sub Total Federal Roads	***32890***	***31821***	***97***	***132462.2***	***169540.8***	***128***
B. Regional Roads						
Construction	24950	24319	98	20603.9	15198.9	**74**
Maintenance				2501.4	2743.6	**110**
Others				203.0	115.4	**57**
Sub total	***24950***	***24319***	***98***	***23308.3***	***18058.0***	***77***

Source 18 years ERA report

Table 8: Summary of 18 yrs. Performance of RSDP

Program	Physical Plan Vs. Accomplishment, km			Financial Plan Vs. Disbursement, in million ETB		
	Plan	Actual	% age	Budget	Disb.	% age
Total RSDP I	8908	8709	98	9812.9	7284.6	74
Total RSDP II	8252	11589	140	15985.9	18112.8	113
Total RSDP III	14686	12395	84	34643.9	34957.9	101
Total RSDP IV	**97,517**	**85,860**	**88**	**125409.1**	**158,333.3**	**126**
Total RSDP (18 yrs)	**129,363**	**118,553**	**92**	**185,851.8**	**218,688.6**	**118**

Source 18 years ERA report

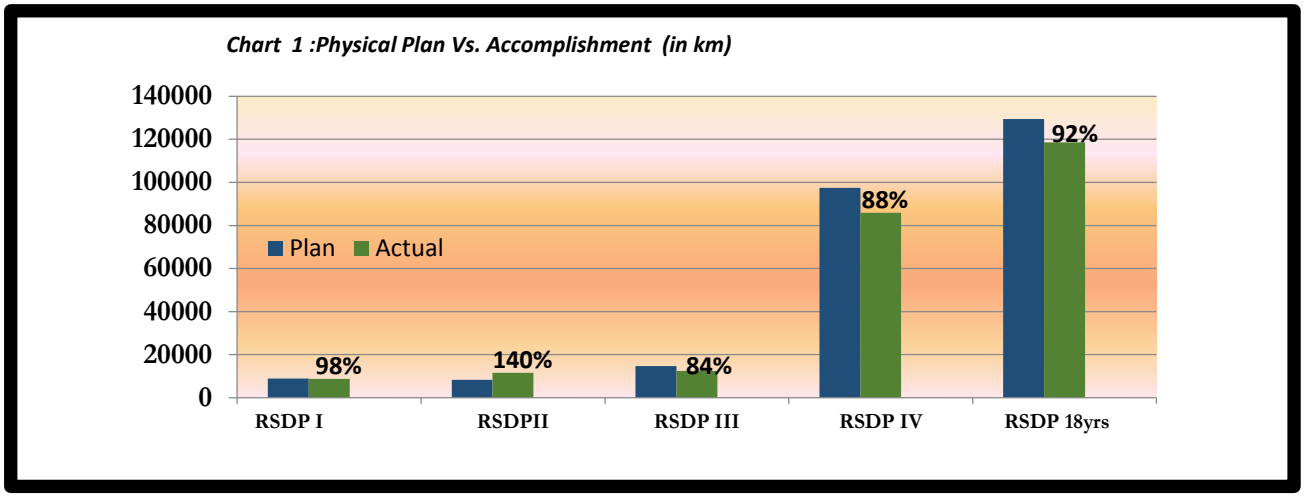

Fig.2: 18 years' physical plan vs accomplishment of RSDP

Source 18 years ERA report

2.14.5. Impact of RSDP

Overall, RSDP is achieving satisfactory progress against its objectives and benchmarks. Substantial results achieved in improving rural accessibility and the condition of the road network.

- Improvement in the size of the road network: The country ‘s road network increased from 26550 km in year 1997 to 110,414 km in year 2015(an increase of 316 percent). As result, the road density per 1000 sq. km increased from 24 km in year 1997 to 100.4 km in year 2015.

- Improvement in the condition of the road network**:** Also, substantial improvement registered in the condition of the country’s road network. The proportion of road network in good condition increased from22% in year 1997 to 70% in year 2015.Table 4 shows the progress made against selected indicators during 18 years of RSDP.

Table 9: Change in Selected Indicators

Indicators	1997 (RSDP Start)	2015 (End of RSDP IV)
Proportion of Asphalt roads in Good Condition	17%	73%
Proportion of Gravel roads in Good Condition	25%	59%
Proportion of Rural roads in Good Condition	21%	55%
Proportion of Woreda roads in Good Condition	-	83%
Proportion of Total Road network in Good Condition	22%	70%
Road Density 1/1000 sq.km	24 km	100.4 km
Road Density 1/1000 population	0.49 km	1.2 km
Proportion of area more than 5 km from all-weather road	79%	36.6%
Average distance to all weather road	21km	5.0 km
Road length (in km) including URRAP Roads	26,550	110,414

Source final 18 years’ assessments report September, 2015 Addis Ababa

2.15. Procurement options and risk management (ERA)

project's procurement practice tends to present reflection of aspects of administrative and financial management systems. Stakeholders in terms of their professionalism, fairness, reliability and transparency can assess these systems. This explains why procurement is not only a process, but also, fundamentally, function that requires considerable attention. (The African Capacity Building Lesson Foundation Note, 2003).

Procurement is an important administrative financial function and process that allows project to obtain optimal value to financial resources expended on goods and services. The effective and efficient use of financial resources in competitive and transparent manner through a sound procurement process contributes for the achievement of the operational and strategic goals of projects. Procurement also expressed as a process used to select the lowest competitive and qualified bidder for procuring services, works, goods from potential competition based on reasonable relevant criteria. (Wubishet J,2006).

According to (Wubishet J,2006). Ethiopian road construction industry uses dominantly traditional procurement option (design- bid- build) where there are three parties' involvement (employer, contractor and the consultant). In this procurement option, the contractor is not responsible for the design related risks but only for the delivery of operations or execute undertaking works in supervision of the consultant who certifies the executed work. The design work usually carried out by design consultants assigned by the employer and as the result, the client takes risks for design works, which executed by consultant assigned by the client in (relation between the contractor and the client). The selection of contractors is usually made based on least evaluated bidder among those who fulfill the pre- qualification requirements.

According to (ERA-SMEC, 2008), usually contract documents developed by the employer or by its representative based on the FIDIC General Conditions of Contracts published in year 1987 and 1999. Accordingly, the contracts follow the FIDIC procedures and risk allocation principles. Apart from that, there are some particular conditions of the contract introduced over the FIDIC General Conditions of Contracts to suite to the country and project situation.

Concerning to this, the contract documents usually copied from others and almost seems the same and needs to improve in their relevance and avoid menaces of risks. therefore, the contract document should be clear, precise, unambiguous, and comprehensive, suitably grouped and with proper site references.

However, most of the contract documents are found to be inconsistent, lacking necessary detailed specification and drawing with under estimation of quantities and even though rarely, with specification which are not practical. These are mainly the result of poor service by the design consultants and non-pro-active approach to the issues during the construction period by the supervision consultants (Zerfu, 2009). This problem affects not only the performance of the projects but also the road sector development program and in general the overall economic growth of the country (Asnake, 2010). It is not surprising to find projects suffering of cost overrun and delay in completion mainly caused by lack of risk management system in the construction industry.

According to (Turkey 2011) based on the result of a desk study on the Ethiopian Federal Road Projects, indicated that out of 30 upgrading and rehabilitation road projects investigated, 24 projects (80%) suffered cost overrun in their execution due to lack of risk management. For road construction projects, the average cost overrun was found to be 26.95% of the contract amount.

The definition of international project evolved for the past twenty years. (Strassman and Wells 1988) defines an international construction project as one undertaken by an enterprise outside its home-country, for example, firms from one country building under contract in another country. However, this definition is not appropriate nor is it sufficient to depict the workings of the global market today. This definition should include projects in home country but involving foreign firms as competitors. (Halawa et al. 2013, and El-Sayegh 2008) There exists construction market where construction work is undertaken by the international construction system comprising firms operating throughout the world (Drewer, 2001).

2.16. Determinants for success in International Construction Projects

The definition of international project evolved for the past twenty years. (Strassman and Wells 1988) defines an international construction project as one undertaken by an enterprise outside its home-country, for example, firms from one country building under contract in another country. However, this definition is not appropriate nor is it sufficient to depict the workings of the global market today. This definition should include projects in home country but involving foreign firms as competitors. (Halawa et al. 2013, and El-Sayegh 2008) There exists construction market where construction work is undertaken by the international construction system comprising firms operating throughout the world (Drewer, 2001).

Due to the location specificity of construction outputs, construction industry is 'local' by nature in terms of climate, regulations, political, institutional, and social conditions that exist in particular locality (Hillerbrandt 2000). This inadvertently gives competitive advantage to homegrown firms over foreign contractors in terms of language, culture, taxation charges, currency restrictions, and project logistics in terms of securing networks of local suppliers and sub-contractors (Flanagan, 1993). The global construction market has been estimated to be about USD 3, 000 billion annually and around one-third of this figure has been undertaken by the international construction system **(**Bon and Crosthwaite 2000).

International projects are found everywhere as more companies establish divisions, seek customers, build partnerships, and outsource work to vendors, suppliers, and contractors in different countries. Due to enhanced communication technologies fueled by the Internet, and the emerging business and technological capabilities of nations such as China and India, companies now seek out and execute projects everywhere. While such projects are attracting because of this sizable benefits and opportunities that come with operating on an international scale, they are at the same time vulnerable to considerable risk and uncertainty. No matter what its objectives or deliverables, a project that is "global," "International," or "overseas" automatically inherits more issues and greater risk than one that is not. (John M. Nicolas, and Herman Steyn).

John M. Nicolas, and Herman Steyn more explained that, regardless of the issues and problems facing the manager of a local, one country project, the manager in an international project automatically faces an "extra layer" beyond those. These extra layers are problems touch most everything about management: Leadership, interpersonal relations, stakeholder, identification and involvement, communication, planning, work definition, estimating, risk management, and work tracking and Control Politics, language, communication, local customs and regulations, transportation, and utilities infrastructure all that pose little or no concern in a home-country project – are potential showstoppers in an international project. Each new international project poses a new set of unknowns. The stakeholders, institutions, natural environments, and technologies differ with each international project. These differences expose the project manager to mistakes and oversights in organizing, planning, and running the project.

Some of the international project management aspects are "explicit" they are somewhat easy to identify and account for in project plans and estimates, others are "tacit" much more difficult to pinpoint and address. The less a project manager knows about the locality of the project, the host country and its people, the harder he must work to make sense out of them and adapt to them. Ignorance about such unknowns makes it difficult for managers to anticipate problems and issues, set priorities, and act appropriately.

2.16.1. International Players

The international construction market dominated by contractors from a few developed countries (Engineering News-Record 1991, 1992, 2000). An analysis done on the figures depicted in the annual Engineering News-Record (ENR) survey on the top 30 international contractors during 1999 to 2000 worldwide. Fifty-eight contractors listed at least once in this group during the period; American contractors the highest number found, followed by Japanese, French, British, and German. Some firms, which do not belong to developed countries, also made significant participations in the international market.

Five firms from Korea (middle-income) and China (low-income) among the 30 top international firms in 1990–2000 During the period of 1990 to 2000, only one construction firm from Malaysia ranked in the top 225 contractors' in ENR. This Malaysian firm Pilecon

Engineering Berhad, ranked 180th in1993. The number of international firms from middle-income and developing countries such as Brazil, China, Cyprus, Korea, and Turkey increased from year 2000 onwards.

Their firm-specific advantages access to inexpensive, highly skilled labor proficient in available technology and close geographical, cultural, and language proximity to their markets (Adams 2008,). In addition, some authors highlight the support from their governments including credits, export guarantees, preferential taxes, and other export development incentives (Betts and Ofori 1994)

2.16. 2. Prerequisites for competitiveness

In order to succeed in the international market, there are certain criterions for construction firm to develop beforehand. Like other business enterprises, construction companies choose oversea markets where they have competitive advantage based on firm and national advantages (Adams, F. K., 2008). Firm specific advantages include the firm's name, which embodies reputation, experience, and expertise; and firm size, which are related to its resources. Internationalizing contractors must possess certain prerequisites, which include the firm's record of accomplishment, corporate knowledge, communication structures, resources, and risk management capability. Some authors (Ustinovichius et al. 2010, Ofori 2003) categorized the key factors contributing to competitiveness in international construction, namely: human resources and their management; technology; and government's incentives and disincentives. Management expertise considered most important because of the peculiarities and problems of overseas projects.

CHAPTER THREE

3.0. MATERIALS AND METHODS

3.1. Introduction

The study carried out using three-phase approach. The first is to review the relevant literature on the subject matter of road construction risk management (from existing knowledge of researchers). In the second phase, a pilot study which took the form of structured questionnaire conducted with road contractors, consultants, the employer ERA and AACRA construction professionals. If there is any unclear primary data or ambiguity from the questioners, further explanation or information obtained through interviews and check list with relevant bodies from ERA. In the third phase, the collected primary and secondary data, analyzed by statistical tools such as chai-square, binomial and Cronbach alpha test using SPSS software. Based on the output analysis, conclusions and recommendations is forwarded.

3.2. Research design and approach

The study adopted mixed research approach where both the qualitative and quantitative methods used. Descriptive statistics (percentage and frequency) approaches, inferential which include chi-square, binomial test also used.

3.2.1. Source and type of data

Primary and secondary data sources are used in this study. Primary data collected were from 43 respondents through questionnaire, interview and checklist. All of the respondents composed of contractors in ERA and are selected by census method. All the primary data were gathered through questionnaire quantitative in nature whereas those gathered trough checklists and interviews have qualitative nature. Secondary data collected from published project reports, research works, and articles in related topics to supplement and substantiate the primary data and that are used throughout this thesis report.

3.2.2. Sampling design and population of the study

The studywas conducted on Local and International road contractors which participated with the Ethiopian road Authority (ERA) and Addis Ababa City Road Authority (AACRA) and others selected from Local and international road contractors. According to the website of ERA (www.era. gov.et on performance of local and international contractors) there are 26 local and 22 international road contractors that actively participated. (Annexed in the Appendix table 1). Therefore, the study used Census method and distributed 48 questionnaires.

3.3. Data collection methods

3.3.1. Primary Data

The source of the primary is in a form of questionnaire, designed to gather large volume of data from client (ERA), consultants, contractors. The primary function of the survey is to collect information that can be analyzed and made to produce conclusion inference. The Questionnaire designed to enable the researcher for extracting information of the study participant and any other related issues. The questionnaire contained open – ended questions, which needed further elaboration and suggestion by the respondent, and also closed – ended questions about the efficiency and effectiveness. Therefore, the questionnaires were designed in such a way that meets the following objectives:

- **User friendliness**: The questions kept short and language is as simple as possible to encourage legibility and maximize the response rate.
- **Comprehensiveness:** the number of questions kept to minimum to encourage responses. However, it is necessary to collect a large amount of relevant quantitative and qualitative data.
- **Respondents:** have an opportunity that they feel to add any other risks which are not covered in the survey, and to indicate the time that they would take to complete the questionnaire.

3.3.2 Secondary Data

Secondary data which involves information from published text such as academics periodicals, research journals, government publications, dictionaries, past dissertations and Internet resources used to compliment the primary data

3.3.3. Sampling

The questionnaires were sent to reputable professionals selected from contractors, client/ERA, consultants AACRA and other construction companies that are considered familiar to the road construction industry in Ethiopia

3.3.4 Data Analysis and Interpretation techniques

After data collected, proper statistical tools and techniques employed for classification and analysis of data. The main tools applied for classifications of data are tables. The analysis of data involved computation of statistics such as frequency, percentage analysis, Chai square and binomial test techniques using SPSS version 20 to indicate the level of agreement or significance of each question applied to analyzed using the p-value and T-test value. The obtained outputs of P-value and T-test are considered the determined factors of the techniques. That is the p-value is the level of marginal significance within a statistical hypothesis test representing the probability of the occurrence of a given event and also used as an alternative to rejection points to provide the smallest level of significance at which the null hypothesis would be rejected. A smaller p-value means that there is stronger evidence in favors of the alternative hypothesis) and T-test is simply the calculated difference represented in units of standard error. The greater the magnitude of T (it can be either positive or negative), the greater the evidence against the null hypothesis that there is no significant difference. The closer T is to 0, the more likely there isn't a significant difference.

- Degrees of freedom (df) are often broadly defined as the number of "observations" (pieces of information) in the data that are free to vary when estimating statistical parameters. Degree of freedom = n-1, where n = Sample size (i.e., number of observations).

- T-test is commonly used to determine whether the mean of a population significantly differs from a specific value (called the hypothesized mean) or from the mean of another population. The t-test calculates a t-value. (The p-value is obtained directly from this t-value.)

$$t = \frac{\bar{x} - \mu_0}{s/\sqrt{n}}$$

Where:

μ_0 = Proposed constant for the population mean

x = Sample mean

n = Sample size (i.e., number of observations)

s = Sample standard deviation

s/sqrt(n) = Estimated standard error of the mean

CHAPTER FOUR

4.0. RESULT AND DISCUSSION

4.1. Results

A total of 48 questioners were distributed for 26 local and 22 international road contractors who have participated in ERA and AACRA. From the distributed questioners 43 of the questioners returned back (23 local and 20 international).

Table 10: Overall survey response level

Group	Questionnaire Distributed	Questionnaire Returned	Percentage Returned %
Local contractors	26	23	88.46
International contractors	22	20	90.9

The general objective of the study is comparative risk management practices between local and international contractors in Ethiopian road construction industry, and dig over the practitioners are managing risks in every day situation of local and international contractors in Ethiopian road construction industry. The main data obtained from respondents are annexed in the appendix part. In the following comparison table 25 listed categories show that analyzed, interpreted and summarized data to compare the practices of road construction risk management practices between local and International road contractors.

4.1.1. Comparison results of risk management practices between Local and International Road Construction Project.

Table 11: Summarized overall survey response level

No	Categories	Types of contractors		Comparison results
		Local	International	
1	Age	52.2% are 31-40, 39.13% are 20-30 and 8.7% are41-50	60% are 31-40, 35% are 41-50 years and 5% are above 50 years.	Age of the respondents is 31-40 years which is 52.2% are local and 60% are international respectively.
2	Education level	81.4% Bsc and 18.6% Msc	60% Bsc and 40% Msc	Regarding to educational level, internationals are more advanced as compare to locals.
3	Field of study	100% civil and construction management	95% are civil and construction management. 5% are claim experts and economics.	In the field of study, they are almost the same, but internationals have claim and an economics experts.
4	Work experience	21.74% 1-5, 30.43% 6-10, 47.83%11-15 years of experience.	15% of the respondents has 6-10 year of work experience and 35% of the respondents has work experience of 11-15 year. And 50% above 16 years of experience	In this part, 47.83% of local contractors have 11-15 years of experience, while 50% of internationals are above 16 years of experiences. So, internationals have more experienced than locals.

5	Study Risk management course	51.74% have studied the course.	85% have studied the course.	About study of Risk management course, there is a significant difference between them. Which is 51.74% and 85% local and international respectively which is 33.20% have difference between them.
6	Knowledge of road construction risk management	100% have fair knowledge of road construction risk management	100% have very good knowledge of road construction risk management	As compare to knowledge of road construction risk management, 100% of locals have fair but 100% of internationals have very good.
7	Roles in road project	13.04% client representative 21.74% contractor representative 52.17% Contract administrator, and 13.04% of Design manager.	25% of the respondents were Client representative 10% of them were contractor representative and 50% of them were Contract administrator, and 15% of them were Design manager.	52.17% of local contractors are contract administrator and 50% of international contractors were Contract administrator.
8	Evaluation of road project implementation (Functionality)	34.78% fairly good, 65.22% very good	15% fairly good while 75% of was very good.	Evaluation of road project implementation (Functionality)there is a slight difference but they are in good condition
9	Cost	100% Fairly good	100% very good	About cost, all local contractors are fairly good while, internationals are very good.

10	Time	73.92% Fairly bad and 26.08% are very good.	15% was fairly good, while 85% very good.	About time ,73.92% local contractors are fairly bad, whereas 85%internationals are very good.
11	Phase of participation in road project construction	60.87% of local contractors are participated in production phase 30.43% are in design and 8.7% are in procurement (bid/cost estimation) phase of road construction project	60% in the phase of program, while 10% in the design phase, and 30% in the production phase of road construction project	Participation in road construction phases, most of local contractors in production phase, but most of international are in program and non-less in production phase
12	Stage of participation in road construction project risk management processes. (risk identification, assessment and response)	40% yes respondents in risk identification stage, 40% yes respondents in risk assessment stage, 81% yes respondents in risk response stage, but test proportion is 75%	85% yes respondents in risk identification stage, 80% of yes respondents in risk assessment and 90%yes respondents in risk response stage, but test proportion is 75%	Regarding to this, local contractors have more participated in risk response stage and less involvement in identification and assessments, whereas internationals are fully participated in identification, assessments and response stages.

13	Formal risk management system consisting of foregoing processes	17.39% yes respondents have formal risk management system consisting of the foregoing processes, and 82.61% respondents replied that there is no formal risk management system consisting of the foregoing processes. But test proportion is 0.75%	100% yes respondents have formal risk management system consisting of the foregoing processes, but test proportion is 0.75%	In formal risk management system, 0.74% local respondents replied that there is no formal risk management system consisting of the foregoing processes, but 100% of internationals have formal risk management system consisting of foregoing processes
14	Planning and selections of methods are source of risk	Inadequate project planning, Inefficient project delivery system and Inappropriate contract award was high sources of risk. Because the observed high response rate 1 is > test proportion .75	Inadequate project planning, Inefficient project delivery system and Inappropriate contract award was low sources of risk. Because the observed low response rate 1 is > test proportion .75	Inadequate project planning, Inefficient project delivery system and Inappropriate contract award was high sources of risk in local contractors, but in the international they are low sources of risk.
15	Funding and Currency fluctuation are sources of risk?	The observed proportion high .87 is greater than the test proportion .75	The observed proportion high .40 and medium .60 is less than the test proportion .75	For local contractors funding and currency fluctuations are sources of risk. But the internationals are not.

16	In solvency /bankruptcy of major participant	The observed proportion high .26 and medium .74 is less than the test proportion .75	The observed proportion high .70 and medium .30 is less than the test proportion .75	In solvency and bankruptcy of major participants are not sources of risk in both contractors.
17	Project management risks (Lack of coordination/communication)	Test proportion was 0.75 which was less than the observed proportion of high response 1.	Test proportion was 0.75 which was less than the observed proportion of low respon…….se rate 1.	The observed high response rate 1 shows lack of coordination/communication is project management risk in local contractors and observed low response rate 1 shows coordination/communication is not project management risk in international. Because test proportion rate is .75
18	Inefficient dispute resolution procedure	The test proportion was 0.75 which was less than the observed proportion high response rate 1	The test proportion was 0.75 which was less than the observed proportion low response 1	The test proportion rate 0.75 is less than high response rate 1 in local contractor.it shows that Inefficient dispute resolution procedure is a risk whereas in international low response rate 1 is greater than test proportion 0.75. It indicates Inefficient dispute resolution procedure is not risk to them.

19	Design risks (Unclear scope of work)	The test proportion 0.75 which was Less than observed high response rate .87.	The test proportion 0.75 which was Less than observed Proportion low response rate .85	The observed high response rate .87 of local contractors is greater than the test proportion .75. It implies that unclear scope of work is design risk, on the other hand, in the international contractors the observed low response rate of .85 is greater than the test proportion .75. It shows that unclear scope of work is not design risk.
20	Unforeseen design exceptions	The test proportion 0.75 was less than observed proportion high response .87	The test proportion 0.75 was less than observed proportion low response rate .80	The test proportion .75 is less than the high response rate .87 in locals and which unforeseen design exceptions is sources of risk and it is not sources of risk in international because the low response rate .80 is greater than test proportion .75
21	Design error and/or omissions	The test proportion 0.75 was less than the observed proportion high response .91	The test proportion 0.75 was less than the observed proportion low response .85	Design error and/or omissions is sources of risk for locals, but not for internationals.
22	Incomplete in adequate survey data	The test proportion was 0.75 which was less than the observed proportion high response 1.	Test proportion 0.75 which was less than the observed proportion low response rate .80	According to the respondents and the test proportion, incomplete in adequate survey data also sources of risk for locals but not for internationals.

23	Incomplete/inaccurate quantity estimates	The test proportion was 0.75 which was less than the observed proportion high response 1.	The test proportion was 0.75 which was less than the observed Proportion low response rate1	Incomplete/inaccurate quantity estimates also sources of risk for locals, but not for internationals.
24	Inaccurate cost estimate	The test proportion was 0.75which was less than the observed proportion high response .79	The test proportion was 0.75 which was less than the observed proportion high response .79	Inaccurate cost estimate is sources of risk for locals, but not for internationals.
25	Emphasis on meeting schedules and increased production volume/ tight schedule/	The test proportion was 0.75which was greater than the observed proportion. High response .4 and medium .6	The test proportion was 0.75which was greater than the observed proportion high response rate 0.40	In this part, it is not sources of risk for both contractors.

4.1.2. Comparison by questionnaire survey of respondents

Based on the above 25 different categories that were resulted from questionnaire and comparisons, on road construction risk management of locals and international contractors are not on the position to compare each other. Because, from above 25 different essential categories of road construction risk management practice they have only the same results in 6 categories which is 24% listed as follows

- age,
- field of study, role in the project,
- Evaluation of road project implementation (Functionality),
- In solvency /bankruptcy of major participant,
- Inefficient dispute resolution procedure, and
- Emphasis on meeting schedules and increased production volume/ tight schedule/ but 19 items which is 76% they are totally different in degree of road construction risk management position.

4.2. Comparison of Engineering and construction management results obtained through check list

To compare risk management practices between local and international road construction industries, check lists were prepared which is annexed. Based on the check lists, the following results identified.

Table: 12 regarding with engineering and construction management risk

No	Check list item	Local contractors	International contractors
1	priorities change on existing program	Not complied	Complied
2	local community attitude objections	Not complied	Complied
3	‘‘loss of public trust /good will”	Complied	Complied
4	political factors change at ‘local’ or “federal”	Not complied	Complied
5	“influential stake holders request additional needs” to serve other purposes	Not complied	Complied
6	political opposition threat of law suits	Complied	Complied
7	“un expected escalation on key materials “	Not complied	Complied
8	“Labor disturbance”	Complied	Complied

As we can see in the preceding comparison table, they agree on three parameters and differ in five parameters.

4.2.1. Comparisons of clear objective and enterprise wide authority results obtained through check list

Table: 13 comparison results of clear objective and enterprise wide authority by check list

No	Check list item	Local contractors	International contractors
1	Right accesses to the institution records, information and personnel	Complied	Complied
2	Report regularly on the effectiveness of the institution risk management process	Not complied	Complied
3	Authority to follow up action taken by management	Complied	Complied
4	Authority of the function head wide in the organization to be effective to fulfilling its mandate	Complied	Complied
5	Independent of day to day management of risk	Not complied	Complied
6	Sufficient staff development	Not complied	Complied

The same comparative explanations go also to this table as 12 above.

4.2.2. Comparison of methods and practices on estimate and schedule risks between local and international contractors

Table: 14Comparison of methods and practices on estimate and schedule risks

No	Check list item	Local contractors	International contractors
1	Estimate reflects local market for labor and subsistence	Not complied	Complied
2	Estimate for unite price adequate for critical item	Complied	Complied
3	logical construction sequencing phasing and parallel activities	Not complied	Complied

The same comparative explanation goes also to this table as 13 above.

To sum up, we can clearly understand from the above tables that local contractors are not familiar with risk mitigation check lists. If we find some similarities, it is simply due to considers of the local contractors during their routine management practices.

4.3. Main results obtained through interviews

4.3.1. Definition of the term risk in view of stakeholders

The question which presented to interviewee; Client, consultants and contractors (local) is "**What does the term risk mean to you?"** Majority of the *clients defined risk as a problem.*

Most of the respondents consider risk as a negative event that can affect the project and cause problems. This confirms the results of study by Akintoye and McLeod (1997), which show negative perception of risk among industry practitioners. In response to the question of what types of risks the respondents dealt with in the project.

This indicates the risks connected with design and productions phase subjected to road construction risk management. Only one respondent mentioned contractual risks and nobody noted organizational risks connected to the relationship between the project stockholders.

Consultants defined risk as probability of uncertainty and most of them mentioned that it gives more theoretical knowledge for consultants. The benefit of considering risk in implementation is minimal.

This indicated that the engagement of consultants in the road construction risk management is very low and practiced only to get theoretical knowledge but not practical aspects of the road construction management risks. It shows that there is no practical experience and engagement.

Contractors defined risk as" *it is an opportunity to get or loss. In my concept, risk has different meaning regarding to the given project and participated actors. Through my experience risk is always transferred to contractors and stakeholders are not alerted for the benefit of risk and loss of the project. Due to this, contractors have forced to negotiate with the project partners rather than practiced, managed and minimized the losses of road construction risks"*

Based on the above information, road construction risk management system is not practiced and growth as required level in the industry and sometimes it is considered as a secondary part for the construction sector.

4.3.2. Risk management

Due to observed problems, risk management interview is conducted to road contractors only because, contractors are facing more risk than others stakeholders. Therefore, the first question presented to the respondent was:

"What does the term risk management mean to you"?

Risk management is a process that all actors should participate actively, and shared the benefits and losses. Within three groups of actors, contractors were the most active in performing risk management. Almost all contractors documented potential project risks and preventive measures. Moreover, contractors had the largest influence on road construction risk management from the perspective of all actors. But contractors have to deal with most risks; due to this, we are forced to be active in risk management process.

Second, "**In what phase do actors participate in road construction risk management"**?
All actors should be participated in all phases in project life cycle. It provides more information and clear understanding about the ongoing processes and progresses of the project rather than waiting report from others.

Third, "In your opinion, does selection of procurement option are sources of risk between actors"? Give an example.

Yes, because in our procurement system the design-bid-build is enforces maximum risk to contractors, but client and consultant are back to the risk in design stage.

Fourth, "What do you suggest to handle construction risks in road construction for the development of local road contractors in the sector"?

- Periodic training should be prepared for all actors and project managers related to road construction risk management to build capacity and skilled man power in the sector.
- The procurement options should be considered in practice of road construction risk management.
- All stakeholders should actively participate in all phases of the projects.

Fifth, "what are the risk mitigation techniques that you practice?"

- Among the stakeholders, the consultants and client don't think of being responsible about the expected risks and they push this responsibility to the contractor. In doing so, the contractor would be forced to search for different ways of escaping from the impacts of the risk; by sharing, transferring and/or minimizing liability; including embracing the result of economic failure.
- As a result of such practice, the client takes the biggest share of the negative impacts at the end of road construction projects.

Sixth, "What preventive measure should take the client (ERA) to improve the evolvement of local contractors and consultant the industry"?

- Creating an opportunity for Joint Venture (JV) and sub-contracting with foreign firms participating in the industry, so that local contractors share skill and experience and thereby overcome the constraint in management skill considering as a rule.

Seventh, "What should be the role of local banks to assist local contractors for the development of the industry"?

- Banks should not only focus collateral of on fixed assets but should offer overdraft and term loans based on contractors' performance and work at hand and minimum risk status.

4.4. Discussions

The practices of road construction risk management in Ethiopia, most of the respondents considered road construction risk as negative event that can affect the project and cause problems. Due to this, knowledge of road construction risk management practice implementation is still limited. Client is a party that owes a project who should be an active participant on road construction risk management practice and demand from the other stakeholders. In current practices, there are limited interests to incorporate road risk management in different phases of road construction.

The participation of the stakeholders on the road project phases can be generally explained that in the traditional procurement option, which is client requests the consultant to prepare the design, the contractor executes and delivering the project. The practices limit the participation of consultant only in design phase and accumulate more risk on contractor. This results very low and limited participation of stakeholders in different phases and led the consultants believe that road risk management is not part of their assignment in the production phase.

Therefore, the results of the finding showed that the higher degree of importance participation of stakeholders on road construction risk management practice should implement in all phases of the project life cycle.

Accordingly, the majority of the respondents feel that road construction risk management is more important in early phases for several reasons:

- Early risk identifications make the client aware of road construction risk and facilitate the choices on selection of an appropriate procurement option.
- Costs of changing in the program phase are less than cost of production phase.
- The client cannot simply proceed with project without taking in to consideration all possible risks.

Lack of effective road risk management in construction projects causes failures, because of un managed risks made in the early stages of road construction process of procurement option. A poorly designed project-delivery approach or the wrong decisions about procurement option can also lead to delays, higher costs of project and poor quality. Road Project risk management has to be a core element of project selection, planning, design, and continuous through the entire life cycle of the project. For each stage of a project, there are some common questions

- Forward-looking risk assessment: which risks is the project facing?
- What is the potential cost of each of these risks?
- What are the potential consequences for the project's later stages as a result of design choices made now?
- Risk ownership: which stakeholders are involved and which risks should the different stakeholders own?
- What risk-management issues do each of the stakeholders' face, and what contribution to risk mitigation can each of them make?
- Risk-adjusted processes: what is the root causes of potential consequences and through which risk adjustments or new risk processes might they be mitigated by applying life-cycle risk-management principles?
- Risk culture: what are the specific desired mind-sets and behaviors of all stakeholders across the life cycle and how can these be ensured

Open discussions of possible risks in the early phases as well as collaborative management of road construction risks throughout the project life cycle is noted to be important. This preliminary works can be drivers of effective road construction risk management. However, it is found that known risks are not communicated in the procurement phase. The reason can be that the stakeholders do not want to raise problems that can influence the price. Many respondents agreed that in current procurement practice the lower bid price of the contract is more important than a thorough analysis of the potential risks. However, to avoid mention of the known risk to get a lower price is a dangerous solution. Detailed communication of the known risks in early phases means that these risks and eventual high costs can be avoided, and both the client and the contractor would beneficial.

A conscious risk allocation is no single condition for an effective road construction risk management. It is important to prevent construction risk in the project and minimize their consequence considering the effect that road risk management practices on the project`s goal in terms of quality and cost, it would be resending able to expect that it is an open process across all phases of the project. Most of the respondents agreed that well-developed document that facilitates clear risk allocation between the stakeholders.

Most of the respondents agreed that well-developed documents that facilitate clear risk allocation between the project's actors. However, the clients often deviate from trying to transfer more risks to the contractor. Deviations make the contract more indistinct for the contractor and may result in conflicts and disputes.

Joint risk management is argued to be the best option for managing unforeseen risks. It is impossible to identify all potential risks in the project, and unforeseen risks always appear during the project implementation. In practice, the stakeholders often have their own management systems and do not use a common database for road construction risk management documents. When describing their work on project risks, the stakeholders often say 'contractor's risk management" and 'client's risk management'. However, 'Joint risk management' is a system where all stakeholders participate in the identification of the risk involved.

In order to apply joint risk management, the following construction risk management system can be used.

- CRMS, the system to integrate and manage procedures regarding risk identification, analysis, response and management for road construction projects in order to make the risk identification easier,
- RBS construction proposed and to utilize it the connection with WBS
- Additionally, problems of existing risk analysis methods reviewed and fuzzy analysis method is used to improve these problems
- CRMS is a web based system, information can be exchanged very easily between field and headquarter that allows easy exchange of information and utilizes not only as risk management tool but also as a part of project management system.

Finally, the researcher`s investigation tend to identify the problems, how these problems are reflected on Ethiopian road contractors than the International ones. In the process, it requires to interview local contractors to find out more information. The result shows that they are not well armed that the stakeholders have limited knowledge about road construction management practices. However, contractors know how risk pushed to them.

CHAPTER 5

5.0. CONCLUSIONS AND RECOMMENDATION

5.1. Conclusions

First, from the questionnaire results, it is concluded that road construction risk management practices of local and international contractors are not on the position to compare each other. Because, from 25 different essential categories of road construction risk management practices, they are agree only in 6 categories which is 24 % of the sample population considered. They vary in 19categories which is 76% of the sample population taken. Hence, the variation is too high to compare the local and international road contractors' practices as shown in table 11 sub title 4.1.1 Comparison by questionnaire survey of the respondents.

Second, the conclusion made from the interview and check list is considered as qualitative. The research concluded based on three different check lists and the results indicate high variation accomplishing the practices between local and international contractors. However, a few checklist practices by local contractors become similar with the international road contractors, due to the management action but not gained through training, knowledge based and they are not familiar with checklist methods in this regard. Therefore, the finding from the interview conducted shows as follows:

- The stakeholders vary with the knowledge of road risk management practices.
- Consultant and client have limited knowledge of road construction risk management practices
- The contractor has better perception concerning road construction risk management only for executing and delving the project at any cost. However, the knowledge is not practiced with the level of requirements of road construction risk management standards
- There is lack of joint risk management practices by stakeholders and lack of knowledge on road construction risk management in the life cycle of road projects,

- Critical risks at the planning and design stages are mostly allocated to the client or consultant while at the construction stage a high percentage of critical risk is allocated to contractors.
- Risk management should be a shared responsibility among stakeholders to the contract
- Training on road construction risk management is needed to ensure quality construction activities at all phases of the project life cycle.

Therefore, the comparisons indicated that the Ethiopian and the international road construction companies vary highly in handling road construction risk management. Therefore, this indicated that all local roads constructed or planned for construction involve high risk management problems.

In summary, the following conclusions are made for the subject under study:

- Considering the stakeholders' perception, there is limited understanding of road construction risk management among the locals; whereas, the international contractors have better understanding of risk management.
- There is no formal method of risk mitigation strategies used by the stakeholders (client, consultant and contractor)
- There is limited practice of road risk management among local contractors due to the fact that in road risk management practices, most Project Managers and Contract Administrators participate only in the production phase without considering the risks in the program and design phases of the project.
- There is no formal road construction risk management system in local road construction but the international ones have better understanding of risk management system
- In road construction risk management, even the identified risks not managed, but are simply transferred to other parties

In addition to that, in Ethiopian road construction industry, formal risk identification and analysis developed to the required level and carried out adequately for projects, usually

decision makers use their experience gained from previous projects to identify and assess the level of impact and the likelihood of occurrence of construction risks to the project in the industry.

5.3. Recommendations

Based on the detailed discussions and conclusion of the studied subject matter the following recommendation is formulated according to the main purpose of the research. Henceforth, the main key problems for the local stakeholders are the lack of knowledge regarding the practices of road risk management. Therefore, the following recommendations set here under:

- All stakeholders should develop their level of understanding about road construction risk management and practices by:
    - Developing standard curriculum or concurrent training by government and concerned bodies for managers of local construction and consulting firms and project engineers in the sector such as: Strategic road construction planning and construction management; joint Venture and sub-contracting agreements; pricing and constructing road that all stakeholders must participate in appropriate knowledge for the work
    - Creating opportunity for Joint Venture (JV) and sub-contracting with foreign firms participating in the industry, so that local contractors share skills and experience and thereby overcome the constraint in management skill that is considering practices of effective road construction risk management

- All stakeholders must be involved in joint risk managements in all phases of road construction risk management life cycle. In addition, there must be nationwide legal requirements which enforce all stakeholders to work together regarding road construction risk management
- Stakeholders should adopt and make use of modern and contextualized risk mitigation strategies such as: contingency planning, quality assurance, separation or relocation of activities and resources, contract terms and conditions, crisis management and disaster recovery plans.
- Road construction risk management subject should be given as separate discipline at Addis Ababa Science and Technology University and other higher learning institutions which specialize in road construction planning and design, at least 1st and 2nd degree level

- Banks should not only focus collateral of on fixed assets but should offer overdraft and term loans based on contractors' performance and work at hand and minimum risk status to support local contractors in the road construction

5.4. Limitations of the study

This study is concerned with identifying critical risk factors of comparative risk management practices for road construction projects in Ethiopia and intends to give a holistic view of possible areas of activities that can be undertaken to improve the local road construction sector.

The research work encountered problems and limitations with lack of knowledge about construction risk management methods and techniques of respondents in most local road construction industry during data collection.

Some of the major problems are:

- Lack of commitment by stakeholders to fill questionnaires and some respondents didn't participate because they were busy in filling questionnaires. Therefore, shortage of time for waiting until getting the responses promised from the respondents.
- Unavailability of literature on the subject area with the context of Ethiopia. It is recognized that the risk management process is not the only factor which affects the Participation of local contractors but it is blue print used to control other hazards of road construction management.

Hence dealing only on this issue will not solve all the problems, but will have a major contribution.

5.5. Proposed future research areas

In the further research, such forms as construction management contracts,

- public/private partnerships (PPP),
- build-operate-transfer (BOT),
- design-build-finance-operate (DBFO) should be explored from the perspective of dealing with risks and
- Adopt Construction risk management system (CRMS), Risk based structure (RBS), work break down structure (WBS) and Fuzzy analysis method to integrate and manage procedures regarding risk identification, analysis, response and management for road construction projects in order to make the risk identification easier.

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Appendixes A

Table: 1Summary of contractors in and out from the industry

Category group	In	Out	Year G.C
GC1	22	11	1999-2005
BC1	29	10	
RC1	3	2	
GC2	1	1	
BC2	3	0	
RC2	0	0	
GC3	11	7	
BC3	34	0	
RC3	1	0	
GC4	4	3	
BC4	86	36	
RC4	1	1	
GC5	90	54	
BC5	191	110	
RC5	1	1	
GC6	586	284	
BC6	228	130	
RC6	1	1	

Source: MoWUD (2005)

Table 2: Socio Demographic characteristics of respondents (Local road contractors)

Socio demographic characteristics include age, work experience, educational status, field of study, knowledge of road construction risk management, and role in the project.

Item Essential Element	Response	Frequency	Percent
Age	20-30 years	9	39.13
	31-40 years	12	52.5
	41-50 years	2	8.7
	50^{+}years	-	-
	Total	23	100
Educational level	Bsc	20	81.4
	Msc	3	18.6
	Total	23	100
Field of study	Civil Engineering and Construction	23	100
	Total	23	100
Work Experience	1-5 years	5	20.9
	6-10 years	7	37.2
	11-15 years	11	41.9
	Above 16 years	-	-
	Total	23	100
Respondents response on Road construction risk management and project management course	Yes	5	39.5
	No	18	60.5
	Total	23	100
Evaluation of knowledge of road construction risk management	Fair	23	100
	Total	23	100
Respondents role in the project	Client representative	3	18.6
	Contractor representative	5	18.6
	Contract administrator	12	41.9
	Design manager	3	20.9
	Total	23	100

Table 3: Evaluation of the road project implementation (local contractors)

Parameters	Evaluation certain	Frequency	Valid Percent	Reliability statistic cronbach's alpha
Functionality	Very bad	-		.563
	Fairly bad			
	Fairly good	8	34.78	
	Very good	15	65.22	
	Total	23	100	
Cost	Very bad	-	-	
	Fairly bad	-	-	
	Fairly good	23	100	
	Very good	-	-	
	Total	23	100	
Time	Very bad	3	13.04	
	Fairly bad	17	73.92	
	Fairly good	-	-	
	Very good	3	13.04	
	Total	23	100	

Table 4: Phase of the road project construction (Local contractors)

Phase of road project construction	Frequency	Percent	Reliability statistics cronbach's alpha
Program	-	-	.790
Design	7	30.43	
Procurement (Bid/cost estimate)	2	8.7	
Production	14	60.87	
Total	23	100	

Appendixes B

List of tables results on field survey study of SPSS (local contractors)

Table 1: Binomial test of Road Construction Risk Management processes

Stage of the road construction project risk management processes	Category	N	Observed proportion	Test proportion	proportion Values
Risk identification	Yes	7	.40	.75	.000
	No	16	.60		
	Total	23	1.00		
Risk Assessment	Yes	5	.40	.75	.000
	No	18	.60		
	Total	23	1.00		
Risk response	Yes	15	.81	.75	.000
	No	8	.19		
	Total	23	1.00		

Table 2: Binomial test of formal risk management system for local contractors

formal risk management system consisting of foregoing processes

Essential Element	Category	N	Observed proportion	Test proportion	p-value
Do you have a formal risk management system consisting of the foregoing processes	Yes	4	.17	.75	.000
	No	19	83		
	Total	23			

Table 3: Binomial test of planning and selections of risks

Roll No	Essential Element	Categories	N	Observed proportion	Test proportion	P-value
1	Inadequate project planning	High	23	1.00	.75	.000
		Total	1.00	1.00		
2	Inefficient project delivery system	High	23	1.00	.75	.000
		Total	1.00	1.00		
3	Inappropriate contract award	High	23	1.00	.75	.000
		Total	1.00	1.00		

Table 4: Binomial test of funding risks

Essential Element	Category	N	Observed proportion	Test proportion	P-value
Currency fluctuation	High	20	0.87	.75	.025
	Medium	3	0.13		
	Total	23	1.00		
In solvency /bankruptcy of major participant	High	6	0.26	.75	.000
	Medium	17	.74		
	Total	23	1.00		

Table 5: Binomial tests of project management risks

Essential Element	Category	N	Observed proportion	Test proportion	P-value
Lack of coordination/communication/	High	23	1.00	.75	.000
	Total	23	1.00		
Inefficient dispute resolution procedure	High	23	1.00	.75	.000
	Total	23	1.00		

Table 6: Binomial test design risks

Essential Element	Category	N	Observed proportion	Test proportion	P-value
Unclear slope of work	High	19	.82	.75	0.25
	Medium	4	.18		
	Total	23	1		
Unforeseen design exceptions	High	20	.87	.75	0.51
	Medium	3	.13		
	Total	23	1.00		
Design error and or omissions	High	21	.91	.75	0.51
	Medium	2	.9		
	Total	23	1.00		
Incomplete/ inadequate survey data	High	22	.96	.75	0.51
	Low	1	.4		
	Total	23	1.00		
Incomplete/inaccurate quantity estimates	High	23	1.00	.75	.000
	Total	23	1.00		
Inaccurate cost estimate	High	14	.79	.75	.339
	Medium	9	.21		
	Total	23	1.00		
Emphasis on meeting schedules and increased production volume/ tight schedule/	High	7	.4	.75	.000
	Medium	16	.6		
	Total	23	1.00		

Appendixes C

Table 1: Socio Demographic characteristics of respondent's (International road contractors)

Essential Element	Response	Frequency	Percent
Age	20-30 years		
	31-40 years	12	60
	41-50 years	7	35
	50^{+}years	1	5
	Total	20	100
Educational level	Bsc	12	60
	Msc	8	40
	Total	20	100
Field of study	Civil Engineering and Construction management	20	100
	Total	20	100
Work Experience	1-5 years		20.9
	6-10 years	3	15
	11-15 years	7	35
	Above 16 years	10	50
	Total	20	100
Respondents response on Road construction risk management and project management course	Yes	17	85
	No	3	15
	Total	20	100
Evaluation of knowledge of road construction risk management	Very good	20	85
	Total	20	100
Respondents role in the project	Client representative	5	25
	Contractor representative	2	10
	Contract administrator	10	50
	Design manager	3	15
	Total	20	100

Table 2: Evaluation of the road project implementation

Parameters	Evaluation certain	Frequency	Valid Percent	Reliability statistic cronbach's alpha
Functionality	Very bad			.563
	Fairly bad			
	Fairly good	5	15	
	Very good	15	75	
	Total	20	100	
Cost	Very bad	-	-	
	Fairly bad	-	-	
	Fairly good		10	
	Very good	20	100	
	Total	20	100	
Time	Very bad		13.04	
	Fairly bad		73.92	
	Fairly good	3	85	
	Very good	17	15	
	Total	20	100	

Table 3: Phase of the road project construction

Phase of road project construction	Frequency	Percent	Reliability statistics cronbach's alpha
Program	12	60	.790
Design	2	10	
Procurement (Bid/cost estimate)			
Production	6	30	
Total	20	100	

List of tables results on field survey study of SPSS (International contractors)

Table4: Binomial test of Road Construction Risk Management processes

Stage of the road construction project risk management processes	Category	N	Observed proportion	Test proportion	proportion Values
Risk identification	Yes	17	.85	.75	.000
	No	3	.15		
	Total	20	1.00		
Risk Assessment	Yes	16	.80	.75	.000
	No	4	.20		
	Total	20	1.00		
Risk response	Yes	18	.90	.75	.000
	No	2	.10		
	Total	20	1.00		

Table 5: Binomial test of formal risk management system consisting of foregoing processes international

Essential Element	Category	N	Observed proportion	Test proportion	p-value
Do you have a formal risk management system consisting of the foregoing processes	Yes	20	1	.75	.000
	No	0	.0		
	Total	20			

Table6: Binomial test of planning and selections of risks

Roll No	Essential Element	Categories	N	Observed proportion	Test proportion	P-value
1	Inadequate project planning	Low	20	1.00	.75	.000
		Total	1.00	1.00		
2	Inefficient project delivery system	Low	23	1.00	.75	.000
		Total	1.00	1.00		
3	Inappropriate contract award	Low	23	1.00	.75	.000
		Total	1.00	1.00		

Table 7: Binomial test of funding risks

Essential Element	Category	N	Observed proportion	Test proportion	P-value
Currency fluctuation	High	8	0.40	.75	.025
	Medium	12	0.60		
	Total	20	1.00		
In solvency /bankruptcy of major participant	High	14	0.70	.75	.000
	Medium	6	.30		
	Total	20	1.00		

Table 8: Binomial tests of project management risk

Essential Element	Category	N	Observed proportion	Test proportion	P-value
Lack of coordination/communication/	Low	20	1.00	.75	.000
	Total	20	1.00		
Inefficient dispute resolution procedure	Low	20	1.00	.75	.000
	Total	20	1.00		

Table 9: Binomial tests of project management risk

Essential Element	Category	N	Observed proportion	Test proportion	P-value
Lack of coordination/communication/	Low	20	1.00	.75	.000
	Total	20	1.00		
Inefficient dispute resolution procedure	Low	20	1.00	.75	.000
	Total	20	1.00		

Table10: Binomial test design risks

Essential Element	Category	N	Observed proportion	Test proportion	P-value
Unclear slope of work	High	3	.15	.75	0.25
	Medium	17	.85		
	Total	20	1.00		
Unforeseen design exceptions	High	4	.20	.75	0.51
	Medium	16	.80		
	Total	20	1.00		
Design error and or omissions	High	17	.85	.75	0.51
	Medium	3	.15		
	Total	20	1.00		
Incomplete/ inadequate survey data	High	16	.80	.75	0.51
	Low	4	.20		
	Total	20	1.00		
Incomplete/inaccurate quantity estimates	Low	20	1.00	.75	.000
	Total	20	1.00		
Inaccurate cost estimate	High	2	.10	.75	.339
	Medium	18	.90		
	Total	20	1.00		
Emphasis on meeting schedules and increased production volume/ tight schedule/	High	17	.4	.75	.000
	Medium	3	.6		
	Total	20	1.00		

Appendix D

Table: 1 Lists of International contractors in ERA

No	Contractor Name
1	CGCOC
2	Dinohydro
3	CIWEC (china international water and electric
4	Keangnam Enterprise
5	Adeniz-KNZ JV
6	China No 17 Metallurgical
7	CCCC
8	Hunan Hunda RBC
9	CGGC (China Gezhouba Group company Co. Ltd
10	Jiangxi Zhongmel Engineering
11	China real way group 7th
12	CRTG
13	China Hyway group
14	The Arab Contractors
15	China Tiesiju Civil Engineering group
16	Hawk International Finance &Construction Co. Ltd.
17	Sato Koyojo Co. Ltd.
18	Kajma Corporation
19	Sew Infrastructure Ltd.
20	Shandog
21	JMC project (India)
22	China First Highway

Table: 2 Lists of Local contractors in ERA

No	Contractors Name
1	SUR Construction
2	Bereh hagos GC
3	Alemayehu Ketema
4	Satcon
5	Yenkomad
6	Sunshine
7	Gemshu Beyen GC
8	Enyi Construction
9	Macro General Contractor & Tradining
10	Defense Construction Enterprise
11	Yosef Teketel
12	Driba Defersho
14	FAL Tradining
15	Orchid

Table continued…….

16	Genet
17	Aster Mengistu
18	Bridge Construction
19	Rama Construction Plc.
20	Kiflom Gebrehiwot GC.
21	ASSER Construction
22	Yemane Girmay GC.
23	ERCC
24	Akir
25	Zeleul Yohans Bc
26	Flint stone

Appendix E

Questioners

Addis Ababa Science and Technology UNIVERSITY
Department OF Civil engineering
Program construction technology and management

A. Objective

The objective of this research is to evaluate how the comparative risk management process is used in the Ethiopian road construction industry, and how the practitioners are managing risks in everyday situation and could minimized specific tools and techniques of risk management between international and local contractors in Ethiopian road construction industry. In addition, evaluate the importance of risk management to international projects and local in financial, procurement options systems of risk management to achieve project objectives.

B. Purpose of the survey and other important information

1. The purpose of this survey is to obtain data for the specified research conducted as a partial fulfillment of Msc. Degree in Construction Technology and Management at Addis Ababa Science and Technology University and the data obtained from the survey will be held confidential and it is used for only academic purpose.

2. For the purpose of this research Risk Management is defined as **a logical, systematic and process oriented approach that: minimizes losses and maximizes opportunities through enabling improvements in decision making; and establish the context for risks involved in any activity or process that need to be identified, analyzed, treated and monitored.**

3. Your open and prompt response is highly essential to fulfill the objective of this research and to address the problem. Any further information the researcher can be reached through 0911613170(Eshetu Adugna)

Instruction: Dear respondents,

1. No need of writing your name
2. Please encircles where alternative answers are available and put (✓) mark where necessary

3. Please write your response on the space provided for open end questions

I. Socio - Demographic Characteristics

General Questions

1. Company/Organization _____
2. Age _____
3. How long have you worked in the road construction industry?

   1-5 years ☐
   6-10 years ☐
   11-15 years ☐
   Above 16 years ☐

4. What is your Educational status? (Tick off your answer)

   BSc. ☐ MSc. ☐

Construction	☐	☐
Economics	☐	☐
Law	☐	☐

Others _____

5. Did you study road construction risk management or/and project management courses?

Yes	No
☐	☐

If yes, what courses? _____

6. How do you evaluate your knowledge of road construction risk management?

Low	Fair
☐	☐

Advance ☐

7. Name of the road construction projects_____
8. Your role in the project:

Client-representative	☐
Client-project manager	☐
Contractor-representative	☐
Contractor-site manager	☐
Contractor-estimator	☐
Consultant	☐
Design manager	☐

Other, namely _____

II. Road construction Risk identification andmanagement and related questions

9. How do you evaluate the road project implementation in terms of the following parameters? (Tick off the most appropriate alternative for each parameter)

Functionality	Very bad	Fairly bad	Fairly good	Very good
	☐	☐	☐	☐
Cost	☐	☐	☐	☐
Time	☐	☐	☐	☐

10. In what phases of the road project constructiondid you participate? (Tick off your answer)

Program	☐
Design	☐
Procurement (Bid/Cost estimate)	☐
Production	☐

11. Were the following road construction risk management processes carried out systematically in the project?

	Yes	No
Risk identification	☐	☐
Risk assessment	☐	☐
Risk response	☐	☐

12. In what phases of risk transfer road construction project were the risk management processes performed? (Tick off one or more alternatives that are suitable in every process)

	Program	Design	Procurement(Bid/Cost)	Production
Risk identification	☐	☐	☐	☐
Risk assessment	☐	☐	☐	☐
Risk response	☐	☐	☐	☐
Risk transfer	☐	☐		

ign)

13. Did you participate in road construction risk management?

If yes, what was your role in road construction risk management?

14. What types of road construction did you assess in the project?
15. How large influence did the road construction actors have on risk management? (Tick off the most appropriate alternative for actor)

	Very small	Fairly small	Fairly large	Very large
Client	☐	☐	☐	☐
Contractor	☐	☐	☐	☐
Consultant/design Manager	☐	☐	☐	☐

16. Assess the importance of road construction risk management in the different phases of the project.

(Tick off the most appropriate alternative for each phase)

	Unimportant	Not so important	Fairly important	Very important
Program	☐	☐	☐	☐
Design	☐	☐	☐	☐
Procurement (Bid/Cost estimate	☐	☐	☐	
Production	☐	☐	☐	☐
				☐

17. Were there deviations in theroad construction in terms of the following parameters?

(Tick off the most appropriate alternative for each parameter)

	Yes, positive deviations	Yes, negative deviations	No
Functionality	☐	☐	☐
Cost	☐	☐	☐
Time	☐	☐	☐

18. Have identified risks that resulted in problems occurred in the road construction.

Yes	No
☐	☐

18a. If yes, what impact on the road construction cost did they have?

Very small	Fairly small	Fairly large	Very large
☐	☐	☐	☐

18b. if yes, why did the risks occur?

18c. if yes, how the problems have solved?

19. Have unforeseen risks that resulted in problems occurred in the road construction?

19b. if yes, why did the risks occur?

19b. if yes, how the problems are solved?

20. Have unforeseen risks that resulted in problems occurred in the road construction?

Yes	No
☐	☐

21. If yes, hat risks?
22. How were unforeseen risks caught in the road construction project?
23. Who did carry out the following risk management processes in the rod construction different phases? (Tick off the most appropriate alternative for each process in every phase)

	Risk response Client	Contractor	Consultant Design Manager	Jointly	Someone else
Program phase	☐	☐	☐	☐	☐
Risk identification	☐	☐	☐	☐	☐
Risk assessment	☐	☐	☐	☐	☐
Risk response	☐	☐	☐	☐	☐
Design phase	☐	☐	☐	☐	☐
Risk identification	☐	☐	☐	☐	☐
Risk assessment	☐	☐	☐	☐	☐
Risk response	☐	☐	☐	☐	☐
Procurement phase	☐	☐	☐	☐	☐
(Bid/cost estimate)	☐	☐	☐	☐	☐
Risk identification	☐	☐	☐	☐	☐
Risk assessment	☐	☐	☐	☐	☐

22. who did have the best conditions to manage the following risks in the road construction? (Tick off the most appropriate alternative for each risk)

	Client	Contractor	Consultant	Joint risk management	Risk did not occur
1) Financial risks	☐	☐	☐	☐	☐
- Price (change in the contract amount due to variation in prices and salaries)	☐	☐	☐	☐	☐
- Delayed payments	☐	☐	☐	☐	☐
- Market (e.g. competition, recession)					
- Bankruptcy (subcontractors)	☐	☐	☐	☐	☐

	Clients	Contractors	Consultant/ Design Management	Joint RM	Risk didn't occur
1) Design risks	☐	☐	☐	☐	☐
- Unsuitable technical solutions	☐	☐	☐	☐	☐
- Changes in design	☐	☐	☐	☐	☐
- Delays in design	☐	☐	☐	☐	☐
- Design errors and missions	☐	☐	☐	☐	☐
- Failure to carry out the works in occur dance with the contract	☐	☐	☐	☐	☐
2) Organizational/contractual risks	☐	☐	☐	☐	☐
- Quality of contractual documents	☐	☐	☐	☐	☐
- Lack of resources during the project execution	☐	☐	☐	☐	☐
- Indistinct contractual relationship	☐	☐	☐	☐	☐
- Supply of labor	☐	☐	☐	☐	☐
- Collaboration problems	☐	☐	☐	☐	☐
- Technology changes	☐	☐	☐	☐	☐
- Delayed deliveries	☐	☐	☐	☐	☐
3) Production risks	☐	☐	☐	☐	☐
- Changes in the project conditions	☐	☐	☐	☐	☐
- Delays	☐	☐	☐	☐	☐
- Lack of quality in project performance	☐	☐	☐	☐	☐
- Lack of material quality	☐	☐	☐	☐	☐
- Lack of materials	☐	☐	☐	☐	☐
- Capacity and productivity of labor	☐	☐	☐	☐	☐
- Project team conflicts	☐	☐	☐	☐	☐
4) Force majeure risks					

5) Force majeure risks

23. Were demands set on special insurances?

Yes	No
☐	☐

If yes, what demands?

1. Relationships between the project actors

This section investigates relationship between the project actors, i.e, client, contractors and consultant.

24. Did you earlier collaborate with other actors in the project?

No one	One actor	Most of the actors	All actors
☐	☐	☐	☐

25. How do you evaluate collaboration between the actors in the project?

Very bad	Fairly bad	Fairly good	Very good
☐	☐	☐	☐

Comments_____

26. Was there collaboration between the actors in managing road construction phase risks?

Yes	No
☐	☐

27a.If yes, in what phases? (Tick off one or more alternatives)

Program	☐
Design	☐
Procurement (Bid/Cost estimate)	☐
Production	☐

27b. If yes, how do you evaluate collaboration in risk management?

Very bad	☐
Fairly bad	☐
Fairly good	☐
Very good	☐

Comments:_____

28. To what extent did the contractor communicate known risks and opportunities in the rod construction?

Not at all	Little extent	Some extent	Great extent
☐	☐	☐	☐

29. Assess how important the following factors were in the project. (Tick off the most appropriate alternative for each factor)

	Un important	Not important	Fairly Important	Very important
Open communication between the actors	☐	☐	☐	☐
- Understanding of other actor's goals	☐	☐	☐	☐
- Effective coordination	☐	☐	☐	☐
- Attitudes of the project actors (trust and commitment)	☐	☐	☐	☐
- Joint responsibilities	☐	☐	☐	☐
- Personal responsibilities	☐	☐	☐	☐
- Established process for dispute resolution	☐	☐	☐	☐
- Frequent meetings	☐	☐	☐	☐
- Readiness for compromises	☐	☐	☐	☐
- Opportunities for future cooperation	☐	☐	☐	☐
- Effective information exchange between the actors	☐	☐	☐	☐
- Fair and open allocation of identified risks	☐	☐	☐	☐
- Fair and open allocation of unforeseen risks	☐	☐	☐	☐

30. How important was quality management software for risk management in the project?

Not at all	A little bit	Fairley much	Very much
☐	☐	☐	☐

31. What other management systems were used for risk management in the road construction?

32. To what extent were these systems used?

33. To what extent were these systems used?

Not at all ☐

A little bit ☐

Fairly much ☐

Very much ☐

33. To what extent should the road construction actors use the following management systems? (set the figures: 1-not at all, 2 – a little bit, 3-to some extent, 4-fairly much, 5-very much)

System	**Client**		**Contractor**			**Consultant**	**Design manager**
	Representative	Project manager	Respresentative	Site manager	Estimator		
Quality management							
Planning system							
Cost estimation software							
Construction management							
Environmental management							
Risk management							

2. Other comments_____

_____

_____

Thank you for your participation!

Interview Questions

General discussion and main definitions to Local contractors in ERA

1. What does the term risk mean to you?
2. What does the term risk management mean to you?
3. What does the term risk identification mean to you?
4. What does the term risk assessment mean to you?
5. What does the term risk response mean to you?
6. What does the term risk transfer mean to you?
7. In what phase do actors participated in road construction risk management?
8. In your opinion, does selection of procurement option as a source of risk between actors? Give an example.
9. What do you suggest to handle construction risks in road construction? For the development of local road constrictors in the sector?
10. What preventive measure should take the client(ERA) to improve the evolvement of local contractors and consultant the industry?
11. What should be the role of local banks to assist local contractors for the development of the industry?
12. What should be done in construction risk management system to integrate risk identification, analysis, response and manage?

Appendix F

Table:1 Road construction risk management check lists

Essential Element	Local contractors	International Contractors
Clear objectives and enterprise-wide authority for its activities;		
Authority to carry out its responsibilities independently;		
Right of access to the institution's records, information and personnel;		
requirement to report regularly on the effectiveness of the institution's risk management processes and on its aggregate exposures compared to approved limits		
Authority to follow-up on action taken by management in response to identified issues and related recommendations		
Appropriateness of the stature and authority of the function head within the organization for the function to be effective in fulfilling its mandate.		
Extent to which the function is independent of day-to-day management of risks.		
Level of resources necessary to carry out responsibilities		
Sufficiency of staff development programs		

Adequacy of process to regularly review and update risk management policies, processes and limits to take into account changes in the industry and in the risk appetite of the institution		
Appropriateness of risk management policies, practices, and limits given the institution's activities and related risks.		
Extent to which risk management policies and practices are co-ordinate with strategic, capital and liquidity management Policies and practices.		
Extent to which risk management policies, practices and limits are documented, communicated and integrated with the institution's day-to-day business activities.		
Adequacy of policies and practices to monitor trends and identify emerging risks, and to respond effectively to unexpected significant events		
Adequacy of policies and practices to report identified issues along with recommendations reporting management of business units		
Adequacy of policies and practices to monitor and follow up on the resolution of the identified issues.		
The policies, practices and limits for managing significant risks and activities.		

Table:2 Engineering and Construction Management Risk Document Checklist

External Risks

DESCRIPTION	Local contractors	International contractors
Priorities change on existing program		
Local communities pose objections		
Loss of public trust / goodwill		
Political factors change at local, state or federal		
Stakeholders request late changes		
New stakeholders emerge and demand new work		
Influential stakeholders request additional needs to serve other purposes		
Political opposition / threat of lawsuits		
Political opposition / threat of lawsuits		
Market conditions and bidding competition		
Unexpected escalation on key materials		
Labor disruptions		
Acts of God (seismic events: volcanic activity, earthquakes, tsunamis; or severe weather: freezing, flooding or hurricane)		

Table: 3Estimate and Schedule Risks check list

DESCRIPTION	Local contractors	International contractors
Estimate excludes contingency and escalation		
Estimate reflects local market for labor and subsistence		
Estimate reflects local market for labor and subsistence		
Estimate reflects local material costs and delivery		
Parametric estimates for unit prices adequate for critical items		
Consideration and local quotes for special equipment (cranes, barges, tugs, diving		
Schedule portrays critical construction features, matching estimate productivity		
Schedule depicts logical construction sequencing, phasing and parallel activities		
Estimate and schedule reflecting “most likely” occurrence Overall confidence in estimate and schedule		

Table: 4Over all road construction risk management observation Checklist

	Risk management reports or document	Local	International
	Risk management plan		
	Risk information form		
	Risk assessment report		
	Risk handling priority list		
	Risk handling plan of action		
	Aggregated risk list		
	Risk management plan		
	Risk monitoring documentation: – Project metrics – Technical reports – Earned value reports – Watch list – Schedule performance report – Critical risk processes reports		
	Organizational and Project Management Risks		
	Project purpose and objectives are poorly defined		
	Project scope definition is poor or incomplete		
	Project schedule in question		
	No control over staff priorities		
	Project competing with other projects, funding and resources		
	Functional and Technical labor units not available or overloaded		
	Losing critical staff at crucial point of the project		
	Inexperienced or inadequate staff assigned		

	Product development by several sources or entities (virtual or remote efforts)		
	Coordination/communication difficulties		
	Communication breakdown with project team		
	Insufficient time to plan		
	Timely response to critical decisions by PM and/or management		
	Consultant or contractor delays		
	Pressure to deliver project on an accelerated schedule		
	Unanticipated project manager workload		
	Internal red tape causes delay getting approvals, decisions		
	Unplanned work that must be accommodated		
	Local agency/regulator issues		
	Priorities change on existing program		
	Contract Acquisition Risks		
	Undefined acquisition strategy		
	Lack of acquisition planning support/involvement		
	Acquisition planning to accommodate funding stream or anticipated strategy		
	Numerous separate contracts		
	Acquisition strategy decreasing competition		
	Acquisition strategy results in higher scope risk (Design Build)		

Technical Risks

	Design development stage, incomplete or preliminary		
	Confidence in scope, investigations, design, critical quantities Geotechnical Civil Structural Mechanical Electrical Architectural Environmental Controls Other Specialized Disciplines		
	Design confidence in products by others		
	Consultant design not up to department standards		
	Inaccurate or risky design assumptions on technical issues		
	Innovative designs, highly complex, first of a kind, or prototypes		
	Incomplete studies (Geotech, hydrology and hydraulic, structural, etc.)		
	Surveys late and/or surveys in question		
	Sufficiency / availability of as-built data / base map data		
	Borrow/fill sources identified / secured		
	Sufficiency/condition of borrow / fill sites		

	Right-of-way analysis in question		
	Lacking critical subsurface information for under-water / in-water work		
	Hazardous waste concerns		
	Need for design exceptions or waivers		
	Adaptive Management features (<3% of construction cost, excluding monitoring)		
	Dredge Estimate scope, quantities, equipment Correct dredge equipment decisions (type, size, number), Reasonable productivity (seasonal, environmental, weather), Consideration for adequate pumping for long pipeline runs, Adequate disposal facilities in size and number		
	Lands and Damages		
	Objections to right-of-way appraisal take more time and/or money		
	Ancillary owner rights, ownerships in question		
	Freeway agreements		
	Railroad involvement		
	Relocations identified		
	Records / as-built availability / inaccuracies		
	Known and unknown utility impacts		
	Relocations may not happen in time		
	Environmental mitigation needs identified		
	Vagrancy, loitering issues		
	Quality of L&D estimates as “most likely” case		
	Hidden estimate/schedule contingencies		

Regulatory and Environmental Risks

	Established requirements for initial project studies and potential impacts		
	Environmental and Water quality issues		
	Conforming to the State implementation plan for air quality		
	Historic/Cultural site, endangered species, or wetlands present		
	Project in an area of high sensitivity for paleontology		
	Project in an area of high sensitivity for cultural artifacts		
	Numerous exclusion zones in project area / vicinity		
	Hazardous waste preliminary site investigation required		
	Status of critical environmental and regulatory studies		
	Status of permits		
	Lack of specialized staff (biology, anthropology, archeology, etc.)		
	Reviewing agency requires higher-level review than assumed		
	Permits or agency actions delayed or take longer than expected		
	Reviewing agency requires higher-level review than assumed		
	Potential for critical regulation changes		
	New permits or new information required		
	Hazardous wildlife attractants on or near airports (FAA involvement)		
	Negative community impacts expected		

Construction Risks

	Accelerated contract schedule		
	Inefficient contractor		
	Subcontractor capabilities		
	Conflicts with other contracts		
	Innovative project construction		
	Permits, licenses, submittal approvals		
	Permit and environmental work windows		
	Environmental restrictions (equipment use, exhaust, paint fumes)		
	Site access / restrictions (highways, bridges, dams, water, overhead / underground utilities)		
	Adequate staging areas		
	Inadequate skilled trades available for labor force		
	Inadequate housing/utilities to support labor force		
	Special equipment and equipment availability		
	Material availability and delivery		
	Productivity of critical work items		
	Critical fabrication and delivery		
	Unknown utilities		
	Survey information		
	Limited transportation / haul routes available		
	Transportation / haul routes constricted or unusable during periods of time		

	Unusual transportation haul distances		
	Regulatory / operational work windows or outage periods		
	Restricted schedule, accelerated schedule impacts		
	In water work		
	Control and diversion of water		
	Differing site conditions		
	Unidentified hazardous waste		
	Historic change order or modification growth		
	Consideration for standard weather impact		
	Adequacy of construction schedule depicting durations, sequencing, phasing, production rates		
	Unidentified hazardous waste		
	Historic change order or modification growth		
	Consideration for standard weather impact		
	Adequacy of construction schedule depicting durations, sequencing, phasing, production rates		

Estimate and Schedule Risks

	Estimate captures scope for all project features		
	Estimate developed for current scope and design level		
	Estimate quality related to lesser designed features		
	Estimate excludes contingency and escalation		
	Estimate(s) quality when developed by others-		
	Estimate confidence in large and critical quantities		
	Estimate include waste / drop off quantities		
	Estimate reflects local market for labor and subsistence		
	Estimate reasonableness of crews and productivities		
	Estimate reflects local material costs and delivery		
	Parametric estimates for unit prices adequate for critical items		
	Consideration and local quotes for special equipment (cranes, barges, tugs, diving)		
	Prime and subcontractor structure matches likely acquisition strategy		
	Adequate schedule depicting all project features		
	Schedule portrays critical construction features, matching estimate productivity		
	Schedule depicts logical construction sequencing, phasing and parallel activities		

	Estimate and schedule reflecting "most likely" occurrence		
	Overall confidence in estimate and schedule		
	Estimate captures scope for all project feature		
	Estimate developed for current scope and design level		
	Estimate quality related to lesser designed features		
	Estimate excludes contingency and escalation		
	Estimate(s) quality when developed by others-		
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	Adequate schedule depicting all project features		
	Schedule portrays critical construction features, matching estimate productivity		
	Schedule depicts logical construction sequencing, phasing and parallel activities		
	Estimate and schedule reflecting "most likely" occurrence		
	Overall confidence in estimate and schedule		

External Risks

	Adequacy of project funding (incremental or full funding)		
	Priorities change on existing program		
	Local communities pose objections		
	Loss of public trust / goodwill		
	Political factors change at local, state or federal		
	Stakeholders request late changes		
	New stakeholders emerge and demand new work		
	Influential stakeholders request additional needs to serve other purposes		
	Political opposition / threat of lawsuits		
	Stakeholders choose time and / or cost over quality		
	Market conditions and bidding competition		
	Unexpected escalation on key materials		
	Labor disruptions		
	Acts of God (seismic events: volcanic activity, earthquakes, tsunamis; or severe weather: freezing, flooding or hurricane)		